

The attached draft report has been approved for distribution, but is expected to undergo minor changes. This version will be replaced with the corrected, formatted versions (both HTML and PDF) as soon as possible.

If you would like to be informed when the formatted versions are available, you can email the HHS/ASPE Office of Disability, Aging and Long-Term Care Policy at webmaster.DALTCP@hhs.gov.

You can also subscribe to our LTC Listserv, which sends out monthly updates on reports recently made available from our website. To subscribe, send an email to: listserv@list.nih.gov and type as the only message:

SUBSCRIBE LTCARE-L your name

ASSISTIVE DEVICE USE AMONG THE ELDERLY:
Trends, Characteristics of Users, and Implications for Modeling

Brenda C. Spillman
Senior Research Associate
The Urban Institute

September 2, 2005

Prepared for the
Office of Disability, Aging, and Long-Term Care Policy
Office of the Assistant Secretary for Planning and Evaluation
U.S. Department of Health and Human Services

Contract # HHS-100-97-0010 T.O. 28

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
INTRODUCTION.....	1
BACKGROUND	2
Complicating Factors for Modeling Efforts	3
Review of Existing Studies	5
Key Issues for Model Building	8
DATA AND METHODS	10
Disability Measures.....	11
Other Measures	16
TRENDS IN ASSISTIVE DEVICE USE.....	19
Trends for Individual Activities	20
Trends in Types of Equipment.....	21
CHARACTERISTICS OF USERS AND NONUSERS OF EQUIPMENT	24
Disability Characteristics	25
Support Characteristics	29
Socioeconomic Characteristics	30
DISABILITY CHARACTERISTICS AND AVERAGE HOURS OF HELP.....	33
SUMMARY AND CONCLUSIONS	37
Key Features of Equipment Use Trends	38
Key Findings for Use and Nonuse of Equipment	39
Hours, Equipment Use, and Independent Equipment Use.....	41
Implications for Conceptual and Empirical Modeling.....	42
REFERENCES.....	46
TABLES.....	49
Table 1. Trend in Assistive Device Use Among Chronically Disabled Community Residents Age 65 or Older, 1984-1999	50
Table 2. Trends in Use of Assistive Devices Among Community Disabled Elderly, by Activity, 1984-1999	51
Table 3. Trend in Use of Specific Devices by Activity among Chronically Disabled Community Residents Age 65 or Older, 1984-1999.....	52
Table 4. Trend in Use of Specific Assistive Devices for All Activities among Chronically	

Disabled Community Residents Age 65 or Older, 1984-1999.....	53
Table 5. Disability Characteristics of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999	54
Table 6. Support and Physical Environment of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999	55
Table 7. Socioeconomic Characteristics of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999	56
Table 8. Mean weekly hours of care for equipment users and nonusers, 1999	57
Table 9. Mean weekly hours of care for persons using both help and equipment.....	58

EXECUTIVE SUMMARY

An intriguing aspect of recent declines in elderly disability is the increased use of disability-related equipment, or assistive devices. Studies consistently have found declines in the overall disability rate among older Americans, with larger decreases in independent living activities, such as meal preparation and shopping, associated with lower levels of disability. Several national surveys also show declines since the mid 1990s in help with personal care activities, such as bathing and toileting, associated with more severe disability. Evidence is less clear, however, when personal care disability is defined to include use of assistive devices, because of the rising prevalence of equipment use. For only one activity, bathing, was an upward trend in the prevalence of equipment use associated with a downward trend in the prevalence of help.

A number of factors argue for the need to better understand the trend in device use and its implications for the growing older population. Research provides evidence that assistive devices may substitute for human assistance under some circumstances, although the full scope and implications of such substitution is not yet known. Nevertheless, if equipment use reduces or removes the need for help from other persons, it may reduce the demands of disability care on both families and public programs and increase independence and quality of life for elders with disabilities and may have other desirable outcomes. Better understanding of trends may help identify where interventions to promote access to disability equipment may be most effective.

This study has four primary aims:

- To update information on trends in use of disability equipment, using data from the 1984 through 1999 rounds of the National Long Term Care Survey (NLTC), which has been a key source of earlier information on trends in equipment use.
- To describe differences in characteristics of equipment users and nonusers.
- To examine differences in the hours of care received by equipment nonusers and by persons using equipment with and without help.
- To discuss implications for multivariate models of the relationship between assistive device use and use of help and impacts of device use on hours of care and other outcomes.

REVIEW OF THE LITERATURE

A number of studies are reviewed that have contributed to understanding of factors associated with use of equipment or help and provided evidence for the intuitive hypothesis that devices may be able to substitute for personal assistance. Much remains to be understood, however, about the scope for potential substitution of device use for personal assistance. This is due in part to limitations in survey data available to address the questions and in part to the inter-relationships between the situation and characteristics of persons with disability and their choices of how to manage their disability. Such inter-relationships complicate both conceptual models and statistical methods required to accurately estimate the relationships between equipment use and hours of care.

Several key issues for modeling were identified from the review:

- It is important to understand how conclusions from global measures of device use may differ from conclusions with respect to particular activities or types of devices. The ability to employ assistive devices may differ depending on the activity, and some devices, notably mobility devices, may have larger impacts because they are used for multiple activities.
- Independent device use for some or all activities intuitively is the place to look for the largest impacts on hours of care, but modeling of potential substitution of devices for hours, needs to take into account the clustering at zero of hours for persons using only equipment and the characteristics that affect the likelihood of being in this group.
- It is important to consider how —and whether—models can differentiate different types of substitution, particularly in cross-sectional data. For example, some types of substitution may not result in reduced hours of care but rather “release” hours of care to other activities.
- Other potential outcomes of device use besides reduced hours of care are important for policy, such as slower functional decline, reduced health care costs, or reduced physical and/or emotional stress on informal caregivers.
- Substitution or supplementation between disability equipment and help occurs at the individual level over time. Equipment may substitute for or supplement help, or the reverse. Whether there is a typical path in choice of disability accommodation and if so what it is remains to be demonstrated. This type of dynamic suggests use of longitudinal models and data to improve understanding of how disability arrangements change as needs change and where policy may be most effective.

DATA AND METHODOLOGY

The NLTCs is a nationally representative survey of persons aged 65 or older designed to identify those who are chronically disabled in one or more ADLs or IADLs and to collect detailed data on their disability, service use, family support, and health and demographic characteristics. The survey provides both longitudinal and cross-sectional samples. For this study cross-sectional samples of community residents reporting chronic disability were selected from the four waves of the survey conducted in 1984, 1989, 1994, and 1999.

Disability items included in this study are six activities of daily living (ADLs), and eight instrumental activities of daily living (IADLs). The ADLs are bathing, dressing, getting around inside, getting in and out of bed (transfer), toileting and eating. The included IADLs are shopping, managing money, meal preparation, laundry, light housework, taking medicines, getting around outdoors, and telephoning. Disability data on the NLTCs differ from that on some other national surveys in that disability is defined by use of help, use of disability-related equipment, or reported need for help with ADLs and inability to perform IADLs. There is no universal screen for difficulty in performing or these activities or equipment use. Detail on types of equipment used is collected for four ADLs (transfer, getting around indoors, bathing, and

toileting) and for getting around outside, the one IADL for which disability-related equipment use is collected.

The disability information is used to describe trends in use of disability equipment with and without help and trends in the types of devices used. In addition, disability characteristics, human and environmental support, and socioeconomic characteristics are examined for chronically disabled elders in 1999, grouped by whether they used only equipment, only help, or both. Hours of care were examined for persons using help only or help and equipment, and, among those using both help and equipment, for persons using equipment *with* help and persons performing some activities with only equipment.

MAJOR FINDINGS

Trends in device use

- Between 1984 and 1999, the proportion of chronically disabled community residents using equipment, with or without help, for all activities for which equipment use could be measured doubled to nearly 30 percent; the proportion relying solely on help fell to 14 percent. Almost 1 million more elders were using equipment with at least one activity in 1999 than in 1984.
- Most of the increase in equipment use was in independent use without human help. Nearly one quarter of disabled elders managed all chronic disabilities with only equipment in 1999, and almost two thirds used equipment independently for at least one disability.
- Bathing was the only activity with a strong upward trend in independent use of equipment and a similarly strong downward trend in sole use of help, but significant increases in independent use of equipment occurred for all four mobility-related ADLs—bathing, getting around inside, transferring, and toileting—and for getting around outside.
- Increases in equipment were not the result of proliferation of complex assistive technology. Simple devices for mobility, bathing, and toileting—walkers, canes and crutches, tub or shower seats, and raised toilet seats—continued to be most common and saw the largest increases, although wheelchairs and scooters also nearly doubled in prevalence.
- When walkers, canes, crutches, wheelchairs and scooters were combined, 70 percent of disabled elders in 1999 were using one of these mobility aids, 50 percent with at least one other device. Only about 16 percent of chronically disabled elders were using only other devices without one of these mobility aids.

Characteristics of Users and Nonusers of Equipment

- In 1999, 1.3 million persons age 65 or older, about one in four chronically disabled community residents, used only equipment for all disabilities; 3 million, or nearly 60 percent used a combination of help and equipment; and only about 15 percent reported using only help with all chronic disabilities.
- Persons managing all chronic disabilities with only equipment were significantly less disabled than persons using both help and equipment on all measures, particularly with respect to

mobility and the frequency with which accommodation was needed.

- The minority who used only help for all chronic disabilities were far less disabled than both groups using equipment. Nearly two thirds were disabled only in IADLs, only 12 percent reported needing help most of the time with any ADL, and about 4 percent reported needing help most of the time for transfer or indoor mobility.
- Sole reliance on equipment did not indicate greater unmet need for help. Essentially none of the group using only equipment for their chronic disabilities reported any unmet need for help with ADLs, compared with about one in five persons using a combination of help and equipment, and about one in 10 persons receiving only help
- Persons managing all disabilities with equipment were most likely to live alone, and to live in some type of senior housing; persons using both equipment and help were most likely to live in an explicit community residential care setting, such as assisted living.
- Persons using only help were most likely to live with a spouse and far less likely than persons using equipment, with or without help, to have any environmental accommodations, such as railings or raised toilet seats, or to consider them desirable.
- Both groups using equipment were relatively similar in age and gender distribution, although persons using a combination of help and equipment were more likely to be age 85 or older.
- Persons relying solely on equipment had higher education and higher income than either group using help.

Hours, Equipment Use, and Independent Equipment Use

- As expected, hours of care received in the last week rose with disability level and generally were higher for the more disabled group using both help and equipment than for the group using only help.
- Frequency of need for help or equipment and frequency of need specifically for mobility or transfer were important; need for accommodation to perform any ADL most of the time more than doubled the hours of help received.
- Within the group using both help and equipment, persons with 3 or more ADLs who used equipment *with* help received far more hours of care than persons performing at least one activity only with equipment; they also received more hours than similarly disabled persons receiving only help.
- Even controlling for the total number of ADL disabilities and the number of activities performed with equipment, all persons with at least 3 ADLs who used equipment *with* assistance received significantly more hours of help than did persons who managed at least one activity with only equipment

- Within each disability level hours rose as the number of activities performed with both equipment and help increased, and fell as the number of activities performed independently with equipment rose.

IMPLICATIONS FOR CONCEPTUAL AND EMPIRICAL MODELING

Better understanding of the relationship between assistive device use and use of help and impacts of device use on hours of care may require longitudinal analyses, more narrowly focused cross-sectional analyses, and more information on health status and changes in functional and other characteristics than have been typical in the literature to date. Studies to date have not determined whether exclusive use of one type of accommodation is most likely to be a transitional situation in a typical progression of accommodations used over time as functional status declines, or whether substantial heterogeneity exists. Longitudinal analyses may be able to provide insights into whether there is a typical ordering of the adoption of accommodations and what factors are associated with changes in accommodations or different orderings.

Analyses focusing on the majority of disabled elders who use some combination of help and equipment, abstracting from the probability of being in this group, may yield important insights into the scope for potential interventions to promote more independent function and into factors associated with greater or lesser hours of care when equipment is used with help. Such a focused analysis also reduces—but does not eliminate—the importance of empirical complexities such as endogeneity of living arrangement and choice of accommodations.

The ability to link Medicare claims history with the NLTCS can help control in either longitudinal or cross-sectional models for unobserved factors that may affect the ability to use equipment alone, such as differences in health and events, such as hospitalization for hip fracture or stroke, or use of post-acute care, and provide additional information on chronic conditions. In either cross-sectional or longitudinal modeling, it also may be important to consider the role of particular disabilities, notably mobility disability, in the accommodations used.

Finally, other outcomes than hours of care are important in studies of assistive device use, including unmet need, impacts on caregiver health, changes in functional status, and health and long term care costs. The 1999 NLTCS includes a supplemental interview of primary informal caregivers which may support analysis of caregiver outcomes for different patterns of accommodation. Recently, additional years of Medicare claims as well as assessment data have become available to federal contractors. These data offer the opportunity to examine the impact of choice of accommodations on outcomes such as nursing home admission, use of home health use, hospitalizations, and Medicare spending, as well as changes in functional status for persons who have assessment data as a result of either nursing home or home health care.

INTRODUCTION

One of the intriguing aspects of recent declines in elderly disability is the increased use of disability-related equipment, or assistive devices. Several studies using different data sources have found declines in the overall disability rate among older Americans, with larger decreases independent living activities, such as meal preparation and shopping, typically associated with lower levels of disability (Spillman 2004; Freedman, Martin, and Schoeni, 2002; Schoeni, Freedman, and Wallace 2001; Waidmann and Liu 2000). One recent study also found consistent evidence across several national surveys of smaller declines in the mid to late 1990s in help with personal care activities, such as bathing and toileting, that are associated with more severe disability (Freedman et al. 2004). Evidence of decline was not clear, however, when ADL disability was defined to include use of disability equipment as well as human help, because of the rising prevalence of equipment use. For only one activity, bathing, was an upward trend in the prevalence of equipment use associated with a downward trend in the prevalence of help (Freedman et al. 2004; Spillman 2004).

A number of factors argue for the need to better understand the upward trend in device use and its implications for the growing older population. Research provides evidence that assistive devices may substitute for human assistance under some circumstances, although the full scope and implications of such substitution is not yet known. Nevertheless, if equipment use reduces or removes the need for help from other persons, it may reduce the demands of disability care on both families and public programs and increase independence and quality of life for elders with disabilities. At least some evidence exists that use of assistive devices also may be associated with slower functional decline and lower health care utilization. Finally, better understanding of which activities and which types of equipment have experienced the largest

increases may help identify where interventions to promote access to disability equipment may be most effective.

This study adds to understanding by updating information on trends in use of disability equipment and exploring how disability and other characteristics differ for equipment users and nonusers. Data are from the 1984 through 1999 rounds of the National Long Term Care Survey (NLTCS), which has been a key source of earlier information on trends in equipment use (Manton, Corder, and Stallard 1993). We first examine several trends in the use of equipment over the period 1984 through 1999, including use of equipment with and without help, use of equipment for specific activities, and use of particular types of equipment. We then examine how disability, characteristics relating to the availability of potential caregivers and environmental accommodations, and socioeconomic characteristics differ for those using and not using equipment, and how hours of care vary by whether and how equipment is used. Finally, we discuss implications for of the findings for models relating to the role of assistive devices in managing disability.

BACKGROUND

Disability is determined not simply by physical limitations, but by the social and physical environment of the individual (Pope and Tarlov 1991). That is, more generally, disability may be defined as the inability to perform any accustomed or socially defined role without accommodation, either in the form of assistive devices or equipment or in the form of help from another person. Human assistance may be either unpaid, informal care from relatives or friends, or paid, formal care. In this study, as in most previous studies of assistive device use among the older population, disability and device use are defined specifically in terms of personal care activities, or Activities of Daily Living (ADLs), such as getting around inside the

home or bathing, and independent living activities, or Instrumental Activities of Daily Living (IADLs), such as shopping and meal preparation.

Devices and other environmental accommodations may either enhance the ability of the person to accomplish a task, for example, a walker or cane to assist in moving around the home, or may reduce the physical requirements of the task, for example, adding environmental features such as railings or grab bars or moving to a more accommodative setting (Agree 1999). Devices also may be used either independently or with help from another person and may either resolve difficulty in performing the task or reduce it, with the latter being more common (Verbrugge, Rennert, and Madans 1997). Studies using measures of global difficulty over multiple tasks have found that assistive devices may be more effective than personal assistance in reducing or eliminating disability (Verbrugge, Rennert, and Madans 1997; Agree 1999). On the other hand, Agree and Freedman (2003) found that for specific tasks, persons who used assistive devices without help were less likely to report a desire for personal assistance, even though they reported as much or more residual difficulty when using devices than did persons using assistance only.

Factors Complicating Modeling

A number of studies have contributed to understanding of factors associated with use of equipment or help and provided some evidence for the intuitive hypothesis that devices may be able to substitute for personal assistance. Much remains to be understood, however, about the scope of potential substitution of device use for personal assistance. This is due in part to limitations in survey data available to address the questions and in part to the inter-relationships between the situation and characteristics of persons with disability and their choices of how to manage their disability. Such inter-relationships complicate both the conceptual models and statistical methods required to accurately estimate the relationships between equipment use and

hours of care.

While some characteristics, such as age, gender, and education for the older population, may be determined outside the model of disability accommodation, others such as choice of living arrangement, are jointly determined with choices about the type of disability accommodation needed (Pezzin, Kemper, and Reschovsky 1996). Failure to take these relationships into account or inability to do so because of data limitations may give misleading results. Plausible determinants related to one aspect of disability accommodation but not to others that may be used as instrumental variables are difficult to conceptualize and, if conceptualized, may not be available in survey data (Hoenig, Taylor, and Sloan 2003). For example, individuals who live alone may be more likely to use equipment independently because they lack readily available helpers, or they may be able to choose to live alone because their disability is such that they can manage it with assistive devices. Similarly, persons living with an able spouse may receive assistance as a matter of course and have less incentive to consider other options for managing disability.

Use of help itself may be a factor influencing whether devices are used if formal providers are more likely to educate clients about the efficacy of devices for some activities or if informal caregivers incorporate assistive devices in order to manage physical and time burdens of caregiving (Agree and Freedman 2000). In addition, disability in the older population, although it may be characterized by long periods of relatively stable function, is a dynamic process. Factors affecting the onset of device use or assistance as needs change may not be captured by the cross-sectional data most often used to study relationships between device use and assistance (Agree and Freedman 2004; Agree et al. 2005; Hoenig, Taylor and Sloan 2003; Allen, Foster and Berg 2001; Agree and Freedman 2000). Nevertheless, published studies

provide a foundation on which to build.

Review of Existing Studies

The only randomized controlled trial to date was a small (104 frail elderly participants in western New York) study conducted by Mann et al. (1999). The study suggests that quality of life may be improved and costs reduced by introduction of assistive devices and environmental modifications. A treatment group was supplied with assistive devices and environmental modifications based on functional assessment and evaluation of their home environment. Relative to the control group, the treatment group had smaller decreases in function and smaller increases in pain scores than the control group. They also had significantly lower expenditures for institutional care, including nursing home and hospital stays, and for nurse and case manager home visits, although not for other home care or for total home care. Although not statistically significant, the difference in total costs, including the higher cost of devices and environmental modifications for the treatment group, was large—about \$14,000 for the treatment group and about \$32,000 for the control group.

Studies applicable to a more general population with disability have relied on survey data, primarily from the 1994-1995 National Health Interview Survey Disability Supplement (NHIS-D) and the 1994 NLTCs. A consistent and intuitive finding across all studies summarized here was that disability-related need was the most important determinant of use of equipment and help and that use of a combination of equipment and help was associated with higher levels of need. Where included, measures of cognitive difficulties have been found to be associated greater hours of care and a lower likelihood of using assistive devices (Verbrugge and Sevak 2002, Hoenig, Taylor, and Sloan 2003, Agree and Freedman 2004; Agree et al., 2005).

Two studies using the NHIS-D made a distinction between the role of simple devices,

which comprise the bulk of devices used by the older population, and more complex devices. Simple mobility devices (e.g. canes) were found to be associated a lower likelihood of using any unpaid, informal assistance among both persons age 65 or older and persons age 18 or older (Agree and Freedman 2000, Allen, Foster, and Berg 2001). Results were more mixed for use of formal care. Agree and Freedman (2000) found no evidence of a negative relationship between device use and use of formal care among the older population and found that complex devices were associated with a significantly higher likelihood of using formal care. Allen, Foster, and Berg (2001), on the other hand, found that among persons age 18 or older use of canes was associated with fewer hours of *both* informal and formal help, whereas use of more complex devices, defined as walkers or wheelchairs, was associated with more hours of both types of help.

Hoenig, Taylor and Sloan (2003) found evidence from the 1994 NLTCS that among those with at least one ADL disability, use of assistive devices for any ADL disability and use of equipment for all ADL disabilities versus none were associated with lower total hours of informal and formal help combined. Use of equipment for some (but not all) activities was not associated with significantly different hours of care relative to use of equipment for all activities. Their findings did not distinguish, however, between sole use of equipment and equipment used with assistance.

Verbrugge and Sevak (2001), in a study of persons age 55 or older using the NHIS-D, did study this margin of use and nonuse of equipment and help, examining characteristics associated with the likelihood of using only equipment, only help, or a combination of the two for bathing, transferring, toileting, and getting around inside. They found that living with a spouse or others generally had the largest impacts on use of only help and use of both help and equipment,

relative to use of only equipment, but did not significantly affect use of both help and equipment, relative to use of only help. The most important predictors of using both help and equipment relative to help only were being unable to perform an activity versus having some difficulty, and the number of physical limitations among eight (e.g. lifting 10 pounds, walking 10 steps without resting). The total number of ADL disabilities significantly increased the likelihood of using help relative to using equipment only for most or all activities and the likelihood of using both help and equipment relative to help only for bathing and transferring.

Agree and Freedman (2004) also used the NHIS-D to examine the characteristics of persons using help only, equipment only, and help and equipment, in their study focusing on mobility disability among persons age 50 or older. In their study they used multinomial logit modeling to examine factors related to having each profile of mobility disability accommodation, in each case relative to having mobility difficulty but using neither help nor equipment. Their findings suggest that severity of difficulty was the most important predictor of both use of equipment and use of help. The largest impacts were for use of equipment with either informal or formal help. Hospitalization within the previous year also was associated with all forms of accommodation. Cognitive difficulty and being married were associated with higher odds of help, alone or with equipment, and with lower odds of using equipment alone.

Agree et al. (2005) applied a more complex approach than other observational studies of the relationship between use of equipment and hours of help. They used a consistent set of covariates in three models: a probit model to explain whether any assistive devices were used and two Tobit models to explain hours of informal and formal care. To assess substitution and supplementation, they examined the signs of coefficients across equations and pairwise correlations between the error terms in the three models. For each characteristic in the model, a

positive coefficient for equipment use and a negative coefficient for either hours measure was considered to be an indication of substitution of equipment use for hours of that type. Two characteristics, being unmarried and having higher education, were associated with a higher likelihood of using assistive devices and fewer hours of informal care. Both characteristics were associated, however, with greater formal care hours. They concluded that a combination of assistive devices and formal care may substitute for informal help. Cognitive problems, conversely, were associated with a lower likelihood of using assistive devices and more hours of each type of help. More severe difficulty and advanced age were associated with a higher likelihood of assistive device use and greater hours of each type. Error correlations were positive between assistive device use and both types of care and negative between the two types of care, leading to the conclusion that, in general, devices supplement help.

Key Issues for Model Building

Several key issues for modeling can be gleaned from what the literature to date has and has not attempted to address:

- It is important to understand how conclusions from global measures of device use may differ from conclusions with respect to particular activities and particular types of devices. The ability to employ assistive devices may differ depending on the activity examined, and some devices, notably mobility devices, may have larger impacts because they are able to be used for multiple activities.
- Independent use of devices for some or all activities would seem intuitively to be the place to look for the largest impacts on hours of care. Modeling of potential substitution of devices for hours, however, needs to take into account the clustering at zero of hours for persons using only equipment for all disabilities and the characteristics and other factors that affect the likelihood of being in this group.

- It is important to consider how—and whether—models can appropriately differentiate different types of substitution that may occur, particularly in cross-sectional data. For example, Agree et al. (2005) note that some types of substitution may not result in reduced hours of care because use of devices for some activities may “release” hours of care to other activities that otherwise would be inadequately addressed. Equipment use also may result in smaller *increases* in hours as disability level increases than seen for persons not using devices.
- Other outcomes than reduced hours of care are important for policy. As discussed, the only randomized controlled trial indicated both functional and cost benefits associated with introduction of devices and environmental modifications. Use of equipment also may reduce the level of physical and/or emotional stress on informal caregivers, who themselves are often elderly spouses, which in turn may prolong the period over which they can provide care.
- Finally, substitution or supplementation occurs at the individual level, can only be observed over time, and may work in either direction. That is, individuals may use assistance in the earlier stages of disability when the need for help is less frequent and then adopt devices, either instead of or in addition to help, as frequency and level of need increases over time. Or they may find it easier to manage with only devices at milder levels of disability and then need to incorporate help as difficulty increases over time. The dynamic nature of substitution and supplementation suggests use of longitudinal models and data to improve understanding of how disability arrangements may change over time as needs change and where policy may be most effective.

The primary purpose of this study is to update information on trends in device use among the older population, both for all devices combined and for individual activities, as background for considering the best approaches to modeling the choice of accommodations among the older population and potential impacts of these choices. The focus is on distinguishing trends in sole

use of equipment, use of both help and equipment, and use of help only. Three domains fundamental to understanding disability arrangements among the older population are examined: disability characteristics, support characteristics, and socioeconomic characteristics.

Finally, differences in hours of care are examined at two margins: 1) persons using only help versus persons using any combination of help and equipment, and 2) persons using equipment with help versus persons using equipment independently for at least one activity. Implications of the findings for both cross-sectional and longitudinal modeling of choice of accommodation and impacts on hours of care are then discussed.

DATA AND METHODS

The NLTCs is a nationally representative survey of persons aged 65 and older designed to identify those who are chronically disabled in one or more ADLs or IADLs and to collect detailed data on their disability, service use, family support, and health and demographic characteristics. The samples are drawn from Medicare enrollment files and represent both community and institutional residents. Once selected for the survey, individuals continue in the longitudinal component, and in each wave a new sample of persons who turned 65 since the previous survey is selected so that each round of the survey provides cross-sectional estimates representative of the population age 65 or older in addition to a longitudinal sample. In 1994 and 1999 new samples of the oldest old also were drawn to preserve precision for older age groups.

For this study cross-sectional samples of community residents reporting chronic disability were selected from the four waves of the survey conducted in 1984, 1989, 1994, and 1999. Unweighted sample sizes are 4,746 in 1984, 3,329 in 1989, 2,962 in 1994, and 2,926 in 1999. All estimates are weighted and standard errors adjusted to take into account the complex survey design.

Disability Measures

Disability items included in this study are six ADLs and eight IADLs. The ADLs are bathing, dressing, getting around inside, getting in and out of bed (transfer), toileting and eating. The included IADLs are shopping, managing money, meal preparation, laundry, light housework, taking medicines, getting around outdoors, and telephoning. Disability data on the NLTCs differ from that on some other national surveys, such as the Health and Retirement Survey and the National Health Interview Survey, in that disability is defined in terms of use of help, use of disability-related equipment, or reported need for help with ADLs and inability to perform IADLs. Although some innovations in screening have been added in the 2005 survey scheduled for release this year, through 1999, there is no universal screen for difficulty in performing these activities on the NLTCs and no unconditional screen for whether devices are used independent of the disability questions. Rather, only new entrants into the survey and other persons who have not previously screened into the detailed interview are asked in a screening interview whether they have “problems” with ADLs when they do not use help or equipment or are unable to perform IADL activities without help because of health or disability.

Persons reporting *chronic* problems or disabilities, defined as lasting or expected to last at least 3 months, continue to a detailed interview about their disability and other characteristics. Persons who have reported chronic problems or disabilities in previous rounds of the survey are automatically selected for detailed interview. Beginning in 1994, subsamples of persons reporting no difficulties or disabilities on the screening interview also have been selected for detailed interview, but they are not asked about help or equipment use in the year in which they are selected.

The significance of this structure for assessing the prevalence of assistive device use is

that it reduces the ability to measure equipment use by persons who do not perceive difficulty or disability because it is resolved by using equipment. Notably, common fixtures such as railings and grab-bars or raised toilet seats may not be perceived as assistive devices if there is no residual difficulty when they are used. A recent study suggests that the margin of persons who use assistive devices but report no difficulty may be sizeable, although limitations of available survey data preclude definitive estimates of the size of this group (Cornman, Freedman, and Agree 2005).

ADL Questions

ADL questions on the detailed interview ask about help and use of equipment in the week prior to interview. For each activity, those who report help are asked if they also use equipment for the activity. Those who report no help are asked if they used equipment to perform the activity, and if yes, they are asked if anyone usually stayed nearby in case help was needed (standby help). Detail on the types of equipment used also is collected for all persons reporting equipment use to perform four of the ADLs: getting in or out of bed, getting around indoors, bathing, and toileting. For these four activities, persons reporting that they do not or cannot do the activity at all are considered to have disability in the activity. Those who report not using the toilet are also asked about equipment, such as special underwear, portable toilets, and catheter or colostomy bag.

For each ADL, respondents reporting help, equipment, or both are asked whether help or equipment was used most of the time, some of the time, or only occasionally. Although these questions do not differentiate between equipment and help, they provide a measure of the frequency of need for accommodation. For those receiving help with an activity, frequency of need would be expected to be positively related to the number of hours of help required, and

frequency for activities such as getting around inside or transferring, which occur more often and are related to other activities such as the ability get to and use the toilet or bathe independently. In the absence of an independent measure of difficulty, frequency of help or equipment also may measure severity.

Respondents also are asked how long help or equipment has been used for each activity, again with no differentiation between help or equipment for those using both. The information about how long the disability has lasted is used to determine whether each disability is chronic, defined as lasting at least three months.

After all ADL questions are asked, for each activity for which no help was reported, respondents are asked whether anyone stayed nearby in case help was needed and, for all activities combined, for how long such standby help has been needed. ADL help measures used in this study include this standby assistance, along with active and standby help reported in the main ADL questions. Two additional questions ask about need for help with each activity for which no help was received and need for more help with each activity for which help was received.

IADL Questions

IADL questions take the general form of asking whether the respondent *usually* performs the activity independently. Thus, unlike the ADL questions, which refer to the previous week, questions about IADLs, which may be performed more intermittently than ADLs, are not tied to a particular reference period. Respondents are considered to have disability in performing an IADL item only if they report that they do not usually perform the activity independently, could not if they had to, and that the reason for inability was health or disability. The additional probe for the reason for inability to perform IADLs is intended to eliminate persons who do not do the

activity because of habit, preference, or social arrangement. A common example is husbands who report that they cannot prepare meals or do housework, although they would be physically able to. Persons who perform these activities independently are asked whether they need help, but there is no probe for the reason why they need help. Nevertheless, within the chronically disabled population examined in this study, it seems reasonable to assume it is an indicator of disability-related need.

Equipment use is assessed for only two IADL activities, getting around outdoors, and telephoning. Questions about getting around outdoors are similar in form to the ADL questions about transfer and getting around indoors. Persons reporting that they do not get around outdoors at all are asked whether it is because of health or disability and if yes are included as having disability in that item. Persons who do get around outdoors are included as having disability if they receive help or use equipment. They are not asked about ability to get around without help if they had to or about the reason for use of help or equipment. For telephoning, respondents are first asked whether they have a special phone (e.g. amplified or with an enlarged dialer), and then are asked whether they usually make their own calls. Only those who report that they do not make calls and could not if they had to are asked whether the reason is because of health or disability.

A final difference in the way IADL information is collected is that there is a single question about the duration of disability in all IADLs reported, rather than separate questions about the duration of each activity. Thus, unlike for the ADLs, it is not possible to identify whether some IADLs are chronic and others are not.

Categorizing Help or Equipment Use

For this study, the analysis sample is persons reporting chronic disability, defined as

using help or equipment for at least three months with at least one of the six ADLs or eight IADLs. In order to capture all equipment use, variables were created for each activity indicating whether equipment and/or help was used, including disabilities that were not reported to be chronic. These variables are used to examine overall trends in use of equipment or help and to examine trends in use of help only, equipment only, or both for individual activities.

In addition, trends in the prevalence of individual types of equipment are reported for each of the four ADL activities for which detail on equipment types is collected and for getting around outdoors. Because phones with special features such as amplification, speakers, and enlarged or lighted keypads are common for the general population, the link between having a special phone and disability would seem less clear than for the ADLs and outdoor mobility. Therefore having a special phone is ignored in categorizing individuals according to their chronic disabilities. When the text refers to persons using equipment for all disabilities, it means all disabilities for which the NLTCs identifies disability-related equipment use. Persons who report disability only in IADLs other than getting around outside have no opportunity to report use of devices, even though they may use them.

In addition, to examine disability and other characteristics of users and nonusers of disability equipment, we categorized individuals in the 1999 sample according to whether they received help or used equipment for their *chronic* disabilities. Those reporting help with any chronic disability are categorized as “help only” if they did not report using equipment with any chronic disability, and were categorized as “help and equipment” if they reported using a combination of help and equipment for any chronic activity or a combination of help only with at least one chronic activity and equipment only with others. Those receiving no help with any chronic disability were categorized as “equipment only.” This categorization also is qualified by

the inability to measure use of devices for IADLs other than getting around outside. The duration of chronic disability was defined as the longest duration over all disabilities reported.

Hours of care

The NLTCS also collects data on all persons “regularly” providing help to respondents reporting help, whether they were paid or unpaid helpers, and the total hours of care each helper provided during the week prior to interview. Hours of help with individual activities are not collected. For this study we use total hours data from the 1999 survey to focus on how hours differed by characteristics in the most recent data. Total hours were missing for about 20 percent of paid and unpaid helpers identified as having helped in the last week. Hours for these helpers were imputed using the mean number of hours per helper of that type (paid or unpaid) for sampled persons with hours reported for all helpers, by type of help received (unpaid only/paid only/both) and disability level (IADL only/1-2 ADLs/3-4 ADLs/5-6 ADLs).

Other Measures

Additional characteristics of users and their situation also are examined using the most recent 1999 NLTCS. They are grouped into support characteristics describing the potential human and environmental supports available to chronically disabled community residents and socioeconomic characteristics.

To characterize the human supports available, a variable was constructed indicating whether respondents lived alone, lived with a spouse (with or without other household members), or lived with other nonspouse household members. In addition, a variable was constructed indicating the residential setting in three categories: a traditional private residence; a supportive setting, such as assisted living or a personal care home; or any other setting described by the respondent as being a complex or building for older or disabled persons.

All community residing respondents to the NLTCS also were asked first to identify all items on a list of potentially accommodative features such as handrails or grab bars that they had in their residence and then to identify all items on the list that “would make things easier or more comfortable.” Although the term “home modifications” is often used for these items, the phrase is not used in the survey, and there is no information on whether the features were added because of disability or already existed in the residence, so the terminology accommodative features is used in this study. The items listed were extra handrails or grab bars, ramps, elevators or stair lifts, extra wide doors or hallways, push bars on doors, and raised toilet. All items except extra wide doors or hallways and push bars on doors are included in equipment types that respondents could report using for one or more ADLs.

Socioeconomic characteristics included are age, gender, race, education, and income of the respondent or respondent and spouse, all of which have been associated with differences in disability and long term care use in the literature. All are self explanatory except income. Total income data on the NLTCS is categorical and is collected in two questions about gross income before deductions in the previous 12 months, one for household income and one for income of the respondent and spouse, if the household included persons other than the respondent and spouse. In 1999, 28.5 percent of respondents were missing total income. The survey also used “unfolding,” a technique for eliciting rough ranges (e.g. “would it be \$25,000 or more,” and if not, “would it be \$10,000 or more,” etc.) from nonrespondents in order to improve imputation. Of the 28.5 percent who were missing income, 12.4 percent provided some information to bracket their income in the unfolding questions, leaving 16.1 percent with no income information reported.

Eight separate hot deck imputations of income category were done to take advantage of

the bracketing of income through unfolding, plus a residual imputation for persons not providing unfolding information. Using the information from unfolding, more select donor groups could be chosen—for example, income greater than \$50,000; income less than \$5,000; income between \$10,000 and \$25,000. Classification variables used in the imputation for nonrespondents who did not provide unfolding information were marital status, age, gender, education, and race, with a general criterion that cells had to have at least 20 donor observations with reported data and at least two donors per imputed observation. Cells not meeting the 20 observation criterion were collapsed, typically by race, because of the small representation of nonwhites on the survey, except where the donor to recipient ratio was high, for example 14 donors to 1 recipient.

For cases where unfolding information was available, the same classification variables as for persons not providing unfolding information were possible, except for race. The smaller samples defined by the unfolding brackets would not support classification by race. For three imputations ($> \$50,000$, $\$25,000$ to $\$50,000$, and $< \$5,000$), only classification by age and gender could be supported by the small donor pools, and for income $\$5,000$ to $\$10,000$, only marital status, age and gender could be supported. Because of the fairly narrow bracketing of income, the inability to take into account all classification variables is less important than in a broader imputation.

The imputed categorical income variable then was used to construct an approximate measure of income relative to the federal poverty thresholds for persons and couples age 65 or older in 1999, up to a top category of four times the poverty threshold or greater. The poverty threshold is relevant because it adjusts for whether income is individual income or income for a couple but also because it is related to potential eligibility for Medicaid and public long term care benefits.

The poverty threshold in 1999 was \$10,075 for elderly couples and \$7,990 for single elders. Because the categorical income data include all increments of \$10,000 through the relevant range, the approximation for couples is very close. For singles, survey categories available were less than \$8,000, which closely approximates the poverty threshold, \$8,000 to \$14,999 for poverty to twice poverty (\$15,980), \$15,000 to \$24,999 for twice poverty to three times poverty (\$23,970), \$25,000 to \$29,999 for three to four times poverty, and \$30,000 or greater for the final category of four times poverty (\$31,960) or higher. Thus, for single persons, the reported poverty thresholds approximated by survey data somewhat understate the proportion with income between poverty and twice poverty and the proportion with income between three and four times poverty and overstate the proportion with income between two and three times poverty and the proportion with income four times poverty or greater. Because of the difference in measurement, separate income comparisons are provided for couples and for single persons.

TRENDS IN ASSISTIVE DEVICE USE

Although the prevalence of disability among all persons age 65 or older declined between 1984 and 1999, the number of community residents age 65 or older with chronic disability rose from 4.7 million in 1984 to 5.1 million in 1999, and the way in which they managed their disabilities changed dramatically (Table 1). Both the number and proportion receiving only human help with disabilities fell while the use of equipment rose. In 1984, nearly 30 percent managed all disabilities solely with human assistance, and only about 15 percent were using equipment, with or without help, for all disabilities. By 1999, those proportions had essentially reversed, with only 14 percent managing solely with help and nearly 30 percent using equipment for all activities. Almost 1 million more elders were using equipment with at least one activity in 1999 than in 1984.

Most of the increase in equipment use was in independent use. The proportion of chronically disabled elders who managed all disabilities with only equipment rose from 13 percent in 1984 to nearly one quarter in 1999, and the proportion managing at least one of their disabilities with only equipment rose from about 53 percent to about 63 percent. The proportion using a combination of equipment and help with at least one disability also rose, from about 36 percent in 1984 to about 45 percent in 1999.

Trends for Individual Activities

Table 2 shows the trends in disability and the prevalence of help and equipment for the seven disabilities for which equipment use can be measured, ordered from most prevalent to least. The prevalence of disability in each activity except dressing increased among community residents with chronic disability between 1984 and 1999, and the use of equipment increased significantly for all seven activities. Increases were largest for disability in bathing, transfer, toileting, getting around outside, and getting around inside, all of which are related to mobility, ranging from 8.6 to 12 percentage points. There was only a 3.3 percentage point increase in disability in eating.

The four mobility-related ADLs also had the largest increases in equipment use, with or without help, ranging from 9.1 percentage points for getting around inside to 22.5 percentage points for bathing. All four also saw significant increases in independent use of equipment, ranging from 4.3 percentage points for getting around inside to 10.5 percentage points for bathing. The IADL mobility item, getting around outside, is distinguished by being the only activity that saw significant increases in *both* sole use of equipment and sole use of help, with a 4.1 percentage point increase in the proportion reporting sole use of help and a 4.9 percentage point increase in equipment use, nearly all of which was in the proportion using equipment

independently. The pattern of change for this item does not show a consistent trend. Notably, all of the significant change in use of help only occurred between 1994 and 1999, and all of the significant increase in independent equipment use occurred between 1984 and 1989.

Bathing stands out as the single activity for which there was a strong and consistent upward trend in equipment use and a consistent downward trend in sole use of help. Between 1984 and 1999, the proportion relying entirely on help fell by 10.5 percentage points while independent use of equipment rose by a similar amount, and use of a combination of help and equipment for bathing also rose by 11.9 percentage points over the period. Nearly one quarter of chronically disabled elders relied entirely on help for bathing and 28 percent used equipment, with or without help in 1984. By 1999, only 13.5 percent relied entirely on help, more than half used equipment, and 24.4 percent used equipment independently.

Toileting, for which there was also a large increase in independent use of equipment, was the only other activity which ended the period with a significant reduction in sole use of help. In this case, however, the reduction was only 2.1 percentage points, and there was no consistent trend over the 1984 to 1999 period. Nevertheless, one in three disabled elders were using toileting equipment in 1999, compared with one in five in 1984, and the proportion using equipment independently (18 percent) was nearly double the 1984 level.

For getting around inside and transferring, the prevalence of equipment use, both independently and with help, also rose substantially but sole use of help for these activities was essentially unchanged over the period 1984 to 1999.

Trends in Types of Equipment

Significant increases occurred in most common types of devices reported for individual activities. Consistent with the literature simple mobility devices were important in the increases.

Table 3 shows devices reported for the five activities for which detail on individual devices used is collected, again ordered from the most prevalent disability to the least. In most cases where the number of unweighted cases for a device was too small or the precision of the estimate too low, devices were combined with the unspecified “other device” category for each activity. The few exceptions are noted in the tables.

Walkers, canes and crutches are the most common device reported for getting around outside, with all of the 5.5 percentage point growth accruing to a doubling of the use of walkers from 9 percent of community residing elders with chronic disability in 1984 to 18.1 percent in 1999. Use of wheelchairs and scooters also increased steadily, nearly doubling in prevalence, but they still were used by only 11.3 percent of chronically disabled elders, compared with about half who used walkers, canes or crutches.

For bathing, there were steady increases in use of all named devices, most of which at least doubled in prevalence. Seats for tub or shower became the most common bathing device over the period and were used by 37.1 percent of chronically disabled elders in 1999, compared with only 14.3 percent in 1984. They were followed by grab bars and railings, which were used by a third of chronically disabled elders in 1999 but only 17.2 in 1984. Rubber mats and handheld showers, devices in common use regardless of disability, also contributed to in rising equipment use for bathing among chronically disabled elders, with 19.3 percent using rubber mats in 1999, compared with only 6 percent in 1984. Whereas the growth in use of hand-held showers, from less than 3 percent in 1984 to 13.6 percent in 1999, may be attributable to the dispersion of such devices in the general economy, rubber mats have been commonplace for many years, so that it is perhaps surprising that they were so uncommonly used by persons with chronic disability in the past. Use of walkers and canes for bathing also increased substantially

in prevalence, but were still used by less than 10 percent of elders with disability in 1999, and there was no trend in use of other, unspecified devices, which were used by less than 3 percent of the chronically disabled in all years.

For getting around inside, as for outdoor mobility, walkers, canes and crutches were the most common devices and increased significantly from 35 percent of chronically disabled elders in 1984 to 43.6 percent in 1999. Also similar to outdoor mobility, the increase in the use of walkers, which rose from 14.5 percent to 25.8 percent of chronically disabled elders, was larger than the modest increase in the use of canes, and use of wheelchairs and scooters roughly doubled, from 8 percent in 1984 to 15.6 percent of the chronically disabled in 1999. Use of hand rails, furniture or walls, and other unspecified devices also increased significantly, but remained relatively uncommon. The same general pattern of increases was seen for getting in or out of bed, although in this case, walkers not only doubled in prevalence, but also became slightly more common than canes after 1989, with one in five chronically disabled elders using a walker to assist in transfer in 1999, compared with 17.9 percent using canes. There was no significant change in use of other transfer equipment, which includes more advanced devices such as lift chairs and adjustable beds.

Simple devices also were most commonly reported for toileting. The largest increase was in raised toilet seats, which became the most common toileting device in 1999, having tripled in prevalence from less than 6 percent of the chronically disabled in 1984 to more than 18 percent in 1999. Hand-rails and grab bars doubled in prevalence to 12.5 percent of chronically disabled elders in 1999. The use of portable toilets increased modestly, but they declined from being the most common toileting device in 1984 to the third most common by 1999, followed closely by canes or walkers, which were used by about 9 percent of disabled elders in 1999, compared with

only about 3 percent in 1984. Although there also was a large increase in use of special underwear or diapers, they still were reported as a toileting aid by only 6.2 percent of disabled elders in 1999, and there was no significant trend in reported use of bedpans or urinals or other toileting devices, including colostomy bags.

Table 4 combines individual types of devices across activities where they are reported for more than one activity and ranks the devices according to overall prevalence. Only devices which have increased in prevalence are shown. Not surprisingly, given their prevalence for multiple activities, walkers, canes and crutches are by far the most common device, with 65 percent of chronically disabled elders using them for one or more activities in 1999, up from 53.1 percent in 1984. They are followed by railings or grab-bars and shower or tub seats, each of which increased in prevalence by roughly 20 percentage points, and were used by nearly two in five chronically disabled elders in 1999. In fact, when the use of walkers, canes, crutches, and wheelchairs are combined (lower panel), 70 percent of chronically disabled community residents were using one or more of these devices in 1999, 50 percent along with devices for other activities and 20 percent without other device use. Only about 16 percent of chronically disabled elders were using other devices but not these dominant mobility-related aides.

CHARACTERISTICS OF USERS AND NONUSERS OF EQUIPMENT

To examine how persons using equipment and help differ with respect to disability and other characteristics Tables 5 through 7 focus on 1999 and group chronically disabled elders by whether they used only equipment, both help and equipment, or only help with their *chronic* disabilities. Persons using equipment only for all chronic activities may also report help with other activities which are not or not yet chronic. Similarly, those reporting only help may report using equipment with activities that are not chronic. In fact, as will be seen, almost none of

those categorized as equipment only for all chronic activities reported any nonchronic activities with help, and almost none of those categorized as help only reported any equipment use. Persons reporting a combination of help and equipment with chronic activities may have reported any combination of help and equipment, including performing some activities solely with equipment and others solely with help, or performing any activity with both help and equipment. No distinction is made between hands-on assistance and supervision.

Disability Characteristics

Nearly 1.3 million persons age 65 or older, about one in four chronically disabled community residents in 1999, reported using only equipment to perform all chronic activities, and 3 million, or nearly 60 percent reported using a combination of help and equipment. Only about 15 percent reported using only help with all chronic activities. Disability characteristics differed dramatically across the three groups, with persons using both help and equipment having the greatest level of disability and those relying solely on help the least.

Equipment Only Versus Help and Equipment

Considering first the distinctions between those who rely solely on equipment and those who use equipment but also use assistance the large majority of both groups reported lower body limitation, but just over one third of those using only equipment had both upper and lower body limitations, compared nearly three quarters of those who also used help, and half had only lower body limitations. Persons using only equipment were also dramatically less likely than those also using help to have each of the seven disabilities for which equipment can be measured. For example, less than 40 percent reported disability in getting around inside, compared with three quarters of elders who also received help, and only small proportions reported disability in either dressing (2.8 percent) or eating (less than 1 percent). About one in five persons reported

disability in only IADLs—specifically getting around outside for this group because all other IADLs are measured only by receiving help—two thirds reported one to two ADLs, and only about 14 percent reported three or more ADLs. In contrast, less than five percent of persons using both equipment and help reported only IADL disability, and the rest were divided roughly equally across the three levels of ADL disability.

There were no differences in the duration of disability reported by the two groups, with roughly 90 percent of each group reporting at least a year of disability, but there were large differences in the frequency with which help or equipment was used. Less than three in five persons relying entirely on equipment reported accommodation most of the time for at least one ADL, compared with about 83 percent of those using both equipment and help. Only about a quarter reported accommodation most of the time specifically for transferring or getting around inside, compared with more than three in five persons using both help and equipment.

Almost none of those classified as using equipment only based on their chronic disabilities reported receiving any assistance with ADL disabilities which were not yet chronic. Thus, the distribution of this group by the number of ADLs with equipment differs from their distribution by disability level only because of the small group (less than 2 percent) who did report help with any nonchronic ADL disability.

Among those using both help and equipment, the pattern of help and equipment use indicates that a substantial proportion were using equipment independently for some or all of their ADL disabilities. Whereas less than 5 percent had disability in only IADLs, 28 percent reported receiving help with only IADL disabilities, signifying that nearly one quarter also had ADLs but managed all of them exclusively with equipment. Similarly, although 31.4 percent reported having 3 to 4 ADL disabilities, only about 15 percent reported help with 3 or 4 ADLs,

indicating that about half with this disability level managed at least one or two ADLs independently with equipment.

Only 6 percent of persons using both help and equipment with their chronic disabilities did not use equipment with any ADL. By definition of the group, this indicates use of equipment only for getting around outside. About 90 percent used equipment with or without help for one to four ADLs. In fact, about half used equipment independently for at least one ADL but all of the 2.2 percent who reported using equipment with 5 or 6 ADLs used it in combination with help (not shown).

The final two measures examined are reported need for help. It is sometimes hypothesized that sole use of equipment may be an indicator of unmet need for help, although Agree and Freedman (2003) reported a lower likelihood of desire for help among those using only devices for particular activities. Consistent with their finding, a negligible proportion of persons using only equipment for all chronic disabilities reported any unmet ADL need, although nearly a quarter reported needing help with IADLs which they performed without help. In contrast, one in five persons who used both help and equipment reported need for help or more help with ADLs, and two in five reported need for help with IADLs for which they received no help.

Personal Assistance Only

Persons relying entirely on help with all chronic disabilities reported substantially less disability than the other two groups. Although nearly 70 percent reported lower body limitations, only about two in five reported disability in getting around outside, and only about one in four reported disability in bathing. Roughly similar proportions, ranging from 11 percent to 17 percent report disability in the remaining ADLs.

For the other two groups, ADLs scaled in the order shown with bathing being the most

common and eating the least common. For the group relying solely on help, however, dressing, transferring and toileting all appear to be more common disabilities than indoor mobility, and disability in eating appears to be nearly as common, although the differences are not significant. This most likely reflects lack of precision because of the small proportion reporting ADL disability. In fact, nearly two thirds of this group reported only IADL disability and another 20 percent reported disability in only one or two ADLs, essentially the reverse of the proportions for persons relying solely on equipment.

One possible explanation for the different disability pattern of the group reporting help only and for the lack of assistive device use could be a higher rate of cognitive impairment. Cognitive problems, which are often associated with IADL impairment, were associated with a greater likelihood of help and a lower likelihood of device use in the studies reviewed. Because the 1999 survey does not include a reliable survey measure of cognitive impairment, data from the 1994 survey were used to investigate this possibility. In the 1994 data, there was indeed a higher rate of cognitive impairment among those using only help (28.8 percent), particularly in comparison with the group relying solely on equipment (9.7 percent). However, about one quarter of elders using both help and equipment in 1994 was cognitively impaired, so it would seem that cognitive state may contribute to the different pattern of disability seen for those relying solely on help but does not fully explain it.

Because persons relying solely on help are only slightly more likely to have been disabled less than a year than the other two groups, the differences in the duration of disability also are unlikely to explain differences in disability patterns. This group does appear, however, to have more intermittent need for ADL assistance, with only about 14 percent reporting that they need help most of the time with any ADL and about 4 percent reporting need for help with

transferring or mobility most of the time. Nearly 11 percent, however, report that they need help additional help with ADL activities, and 41.8 percent that they need help with IADLs for which they receive none, a proportion similar to that for the group using both help and equipment.

Support Characteristics

Table 5 compares living arrangement, type of residence, and type of accommodative features present in their homes or perceived to be valuable for the three basic groups from Table 4. These measures indicate the types of human and environmental supports available, but it is important to remember that these measures are related in complex ways to both disability level and use of assistance for long term care needs. That is, for example, persons who are not able to manage their disabilities without help are more likely to choose to live with others, hire assistants, or live in a supportive setting.

Persons managing all their chronic disabilities with equipment are far more likely than other chronically disabled community residents to live alone (54.7 percent) and less likely to live with either a spouse or others. They are also more likely to live in some type of housing for senior citizens or persons with disability, although not more likely to live in a residential care setting. Living in housing designed for older persons may contribute to this group's high likelihood of reporting accommodative features. Less than half report having no such features, about 44 percent report handrails or grab bars, and about 16 percent report having a raised toilet. Less than 30 percent identify desirable items they feel would make things easier or more comfortable, the most common again being handrails or grab bars (17.4 percent) and a raised toilet (9.1 percent).

It is interesting to note that there are few significant differences between those using only equipment and those using both help and equipment in the environmental accommodations

present or considered desirable, the exceptions being the lower percent of persons using equipment only who report having or wanting raised toilet seats and ramps, or wanting wide doors or halls. A similar proportion of the two groups report having no accommodative features in their homes (45 percent and 41.5 percent), but those using both help and equipment are more likely to identify at least one feature that they feel would be desirable.

Comparing the two groups using help, there is no significant difference in the proportions who live alone, but those using both equipment and help are somewhat less likely to have a spouse and more likely to live with others. Although living in residential care is uncommon for all groups, those using both help and equipment also are most likely, at 7.2 percent, to live in such a supportive setting, compared with only 3.1 percent of those receiving only help. About 8.6 percent of both groups live in some other type of housing for seniors.

The most notable difference between the two groups using help is the small proportion of persons using only help who identify any environmental features they either have or would find desirable. Only 20 percent of this group reports having any such features, compared with nearly 60 percent of the group using both help and equipment, and about 20 percent identify any desirable features, compared with 35 percent of the group using both help and equipment. The lack of accommodative features or desire for them presumably is related to nature of the items listed, all of which are related to mobility or toileting, and the lower disability level of the group using only help. Only 35 percent of this group reported any ADL disability, compared with nearly all (96 percent) of persons reporting both help and equipment, about 13 percent disability in getting around inside, and 14 percent reported disability in toileting.

Socioeconomic Characteristics

The demographic and economic characteristics shown in Table 6 all have been found in

previous research to be related to disability and long term care use, and unlike the support characteristics in Table 5, they are for the most part determined externally. That is, for example, educational attainment is determined much earlier in life in nearly all cases, so that the direction of causation can be assumed to be from education to the choice of disability accommodation. Although income can be affected in a number of ways by need for long term care, particularly over time, it is reasonable to assume that in cross-section, it operates primarily as an enabling characteristic affecting long term care choices either through ability to pay for formal services or likelihood of qualifying for Medicaid long term care benefits. Lower economic status, however, is also associated with poorer health and higher mortality and morbidity (Fuchs 2004). Disability also rises with age and is more common for women, who have greater longevity than men and historically have been more likely to have chronic diseases associated with mortality (Guralnik et al. 1997; Verbrugge 1990).

Recalling that the group using both help and equipment has the highest level of disability and the group using help only the least, it is interesting to note that the two groups using help tend to be more similar with respect to education and income, and the two groups using equipment are more similar with respect to gender and age. There are no significant differences in race across the three samples.

Considering age and gender first, 37.4 percent of persons relying solely on help are under age 75, compared with about a quarter of those using equipment, with or without help, and they are also far more evenly divided between genders, with about 57 percent female, compared with about 70 percent for the groups using equipment. It will be recalled that a larger proportion of this group—nearly half—were still married and living with a spouse (Table 5). On the other hand, although both groups using equipment are more likely to be 75 or older, nearly one third of

the group using both help and equipment is age 85 or older, while nearly half of the group using only equipment is in the 75 to 84 age range. This is consistent with the hypothesis that advancing age and frailty may increase the need for help even among equipment users, although the ordering of adoption of the two types of accommodation has not been demonstrated in the literature, and the relatively younger age of the group using only help does not support the hypothesis.

Although higher education has been associated with greater likelihood of equipment use, that appears to be true only for those who manage all chronic disabilities with equipment. Only about 36 percent of this group has less than a high school education, compared with about half of the two groups who use help, and nearly one in three have some college, compared with less than one in four of the groups using help. This appears to imply that lower education is more strongly related to use of help, but also may be related to the older age of the group using both help and equipment because educational attainment has increased over time.

Similarly, the group using only equipment appears to have higher income than the group using both help and equipment, which also may be related to age. They are significantly less likely than those using both help and equipment to have income below twice the poverty threshold if married, significantly less likely to have this low income level than either of the groups using help if unmarried, and significantly more likely than either group to have income above three times the poverty threshold, regardless of marital status. It is worth noting the proportion of married persons with income below twice the poverty threshold is substantial, ranging from about 36 percent for those managing only with equipment to just over half of those using both help and equipment. Unmarried persons have even lower incomes, with the proportion having income below twice poverty ranging from nearly two-thirds of persons

managing their chronic disability with only equipment to more than three-quarters of those receiving only help.

DISABILITY CHARACTERISTICS AND AVERAGE HOURS OF HELP

Consistent with previous research, the most important differences in characteristics of persons using equipment or help independently and persons using a combination of help and equipment were in their level of disability. Tables 5 and 6 examine differences in total weekly hours of help reported by persons receiving help relate to disability characteristics. Hours of help with individual activities are not collected.

Table 5 shows the average total hours of care in the past week associated with each disability measure in Table 4. In addition, total hours by the *number* of ADLs for which frequent help or equipment use is needed. Persons using only equipment for all activities are excluded to focus on how hours are affected by differences in the extent of equipment use among those using some help. Hours are provided in Table 5 for the group reporting help only for all chronic disabilities, but because of small sample sizes that result in poor precision, discussion focuses on the much larger group using both help and equipment. Table 6 then focuses on the latter group using both help and equipment to examine how hours of care differ at each level of disability when some activities are managed solely with equipment.

For the most part, total hours of help rise predictably with disability level and are higher for persons with lower prevalence disabilities associated with more severe and multiple disabilities, such as eating disability, than for persons with other more common disabilities, such as getting around outside (Table 5).

Persons using both help and equipment receive 41 hours of care in a week—15 hours more than persons who rely solely on help, consistent with their higher level of disability. Hours

of help rise with both level of physical limitation and disability level among persons using both equipment and help. For example, the nearly three-quarters of this group with both upper and lower body limitations receive an average of about 46 hours of care per week, compared with 25 hours for persons with no limitations or only upper body limitations and 27 hours for persons with only lower body limitation. Persons receiving assistance with eating, typically associated with a larger number of disabilities, receive about 75 hours of help per week, compared with 42 hours for persons with disability in getting around outside, the highest prevalence disability among those for which equipment use is measured. Persons with disability only in IADLs receive about 19 hours of help per week—about half the average for all persons using help and equipment—and average hours rise with the number of ADL disabilities to 70 hours for those with disability in five or six ADLs.

Duration of disability does not appear to be related to hours of care, but greater frequency of need for help or equipment is associated with substantial increases in hours of help. Persons needing help or equipment most of the time for any ADL disability receive about 44 hours of help, 20 hours more than received by those not reporting this level of need. Frequent need for help or equipment for transfer or indoor mobility has a similar impact. The number of hours also increases dramatically with the number of ADLs for which help or equipment is needed most of the time. Persons using both help and equipment who report needing accommodation most of the time for five or six ADLs receive an average of 86 hours of help per week, compared with just under 30 hours for those needing help or equipment most of the time for only one or two ADLs.

Hours of care rise also rise steadily with both the number of ADL disabilities for which help is received and the number with which any equipment is used. In fact, persons using

equipment with one to two ADLs receive about 9 more hours of help in a week than persons using help with one to two ADLs. This does not indicate that use of equipment per se increases hours of care. In Table 4 it was seen that about 32 percent of persons using both help and equipment had one or two ADL disabilities, but nearly 48 percent use equipment with that number of ADLs. Thus, about one third of this group receives help with more than 2 ADLs but uses equipment with only one or 2 of them.

In contrast, for the 15 percent of elders with chronic disability who use only help, hours of help are significantly higher for those with any ADL disabilities, but there is little variation in the number of hours of help associated with different ADLs. Apparent increases in hours associated with greater numbers of ADL disabilities are not significant, reflecting in part the lack of precision because small sample sizes. Where significance differences are found between the group using only help and the group using both help and equipment, they indicate that the group using both help and equipment use *more* hours of care, consistent with their higher average disability level. This is true for persons with both upper and lower body limitations, disability in dressing or eating, and for all durations of chronic disability. For variables explicitly related to the number of disabilities—the number of ADLs with help or equipment most of the time and the number of ADLs with help—there is some evidence that equipment users may receive fewer hours of care, particularly when controlling for the number of activities with which frequent ADL help is needed, but the differences are not significant.

Interestingly, for both groups, persons reporting the need for help or more help with ADLs are already receiving significantly more hours of care than those who report no unmet need for ADL help. The difference is slightly larger for person using only help (18 hours) than for persons using both help and equipment (14 hours). This may reflect in part the lower likelihood

of reported unmet need among persons using equipment independently. As noted in the discussion of Table 4, slightly more than half of persons using both help and equipment use equipment independently for at least one ADL disability.

Table 6 examines more closely the relationship between independent use of equipment and hours of care, limited to persons who used a combination of help and equipment. That is, setting aside differences that may explain whether *any* equipment is used, Table 6 examines how hours of care differ by disability level for groups using equipment *only with help* and those using equipment alone for some activities. Statistical significance is indicated for differences in hours for persons using equipment alone relative to persons using equipment only with help, controlling for number of ADL disabilities and number of activities with equipment.

It is obvious that any given level of disability defined by the number of disabilities, hours of help would be expected to fall with increased numbers of activities performed independently with equipment. However, the estimates in Table 6 suggest that the most important place to look for opportunities to substitute equipment for assistance is for persons with at least three ADL activities and at the margin between independent performance with equipment and the use of both help and equipment.

There is essentially no difference in hours of help between persons using equipment with and without help in Table 8 below the 3 ADL level, and moreover, no difference from the group with fewer than 3 ADLs using only help shown in Table 7. In fact, the hours shown in Table 7 for persons using only help with 3 or more ADLs are significantly lower than for those using help *with equipment* and significantly higher than for those using equipment *independently* for any activities. Thus it would appear that the group using equipment independently is the source of the apparently (albeit not significantly) lower hours for persons using a combination of help

and equipment in Table 7 relative to those relying solely on help. This suggests that a key question to be answered is whether unmeasured differences in disability severity, illness, general frailty, or attitudes and preferences within a given disability level explain the ability to perform some activities with only equipment, or whether there are opportunities for improving fit between devices used and the user or other ways of increasing the likelihood that persons using equipment *with* help could function more independently.

Roughly equal proportions of persons using both equipment and help use equipment with help or independently. Persons using equipment with help, however, are far more likely to have very high levels of disability, and hours of help *rise* with the number of activities performed with both help and equipment, within disability level.

Persons with five or six ADLs who use equipment with help for one or two ADLs received 62 hours of help in a week, compared with 20 fewer hours for similarly disabled persons performing one or two ADLs with equipment alone. Differences are even more dramatic for independent performance with equipment of three or four ADLs. (No one at this disability level performed five or six ADLs solely with equipment.) Clearly, if an intervention was able to allow even a fraction of the roughly 800,000 persons with five or six ADLs using equipment with help to use it independently, substantial reductions in hours of care could be realized.

SUMMARY AND CONCLUSIONS

This study has confirmed and updated information about the dramatic increases since the mid 1980s in use of disability-related equipment by community residing older persons with chronic disability. Between 1984 and 1999, the proportion of chronically disabled community residents using equipment, with or without help, for all seven activities for which equipment use

can be measured on the NLTCS doubled to nearly 30 percent, and the proportion relying solely on help fell to 14 percent. Equipment use is measured for six ADLs, bathing, getting around inside, transferring, toileting, dressing, and eating, and for one IADL, getting around outside. Almost 1 million more elders were using equipment with at least one of these activities in 1999 than in 1984.

Key Findings for Equipment Use Trends

Most of the increase in equipment use was in independent use without human help. Nearly one quarter of chronically disabled elders managed all chronic disabilities with only equipment in 1999, and almost two in three used equipment independently for at least one disability. The proportion using a combination of equipment and help with at least one disability also rose, from about 36 percent in 1984 to about 45 percent in 1999.

The increases in use of equipment occurred for all seven activities, but for only one, bathing, was a strong and consistent upward trend in independent use of equipment accompanied by a similarly strong and consistent downward trend in sole use of help. Nevertheless, significant increases in independent use of equipment occurred over the period for all four mobility-related ADLs—bathing, getting around inside, transferring, and toileting—and for getting around outside.

Increases in equipment were not the result of proliferation of complex assistive technology. Simple devices for mobility, bathing, and toileting—walkers, canes and crutches, tub or shower seats, and raised toilet seats—continued to be most common and saw the largest increases, although wheelchairs and scooters also nearly doubled in prevalence. Nearly two-thirds of chronically disabled elders were using walkers, canes, or crutches for at least one disability in 1999, one in five used a wheelchair or scooter, half used one or more simple devices

to assist with bathing, and one-third used one or more devices to assist in toileting, most commonly a raised seat. When walkers, canes, crutches, wheelchairs and scooters were combined, 70 percent of elders in 1999 were using one of these mobility aids, 50 percent with at least one other device. Only about 16 percent of chronically disabled elders were using only other devices without one of these mobility aids.

Key Findings for Use and Nonuse of Equipment

In 1999, 1.3 million persons age 65 or older, about one in four chronically disabled community residents, used only equipment for all disabilities; 3 million, or nearly 60 percent used a combination of help and equipment; and only about 15 percent reported using only help with all chronic disabilities. Both disability characteristics and other characteristics indicating human and environmental supports and socioeconomic status differed significantly across these groups defined by accommodations used.

Persons managing all chronic disabilities with only equipment were significantly less disabled than persons using both help and equipment on all measures. Differences relating to mobility and the frequency with which accommodation was needed were particularly notable. Although a substantial proportion of elders using only equipment (84 percent) had lower body limitations and about three in four reported disability in getting around outside, less than two in five reported disability in getting around inside the home and only one in four reported that equipment was needed most of the time for transferring or getting around inside. In contrast, nearly all persons using a combination of help and equipment reported disability in getting around outside, three quarters were disabled in getting around inside the home, and almost two thirds required help or equipment most of the time for transfer or getting around inside.

The minority of chronically disabled elders who used only help for all chronic disabilities

were far less disabled than both groups using equipment. Nearly two thirds were disabled only in IADLs, only 12 percent reported needing help most of the time with any ADL, and about 4 percent reported needing help most of the time for transfer or indoor mobility.

Sole reliance on equipment did not indicate greater unmet need for help. Essentially none of the group using only equipment for their chronic disabilities reported any unmet need for help with ADLs, compared with about one in five persons using a combination of help and equipment, and about one in 10 persons receiving only help. All groups reported needing help with IADLs for which they were receiving none, but only about one in four persons using only equipment reported unmet IADL need, compared with about two in five of the groups already receiving help.

Consistent with findings in previous research, persons managing all disabilities with equipment were most likely to live alone, while persons relying solely on help were most likely to live with a spouse. Persons using equipment alone also were most likely to live in some type of senior housing, but persons using a combination of help and equipment were most likely to live in an explicit community residential care setting, such as assisted living or a personal care home. The largest distinction between the two groups using equipment and the group using only help was that more than 80 percent of the group relying entirely on help reported that they neither had nor considered desirable any of the list of accommodative features, such as railings or raised toilet seats, included in the NLTCs. This may be related to the far smaller proportion of this group reporting ADL disabilities to which most of the included features would relate.

Comparison of socioeconomic characteristics revealed that the two groups using equipment were relatively similar with respect to age and gender distribution, although the group using both help and equipment was more likely to be age 85 or older. On the other hand, the two

groups using help were more similar with respect to both education level and income, with the group using equipment independently for all disabilities having more education and higher income than either group using help.

Hours, Equipment Use, and Independent Equipment Use

Total weekly hours of help first were examined for all persons using help, to compare hours for persons using only help and persons using some combination of help and equipment. Estimates showed the expected pattern that hours rise with disability and generally were higher for the more disabled group using both help and equipment. The frequency of need for help or equipment also was important. For both groups, needing accommodation to perform *any* ADL most of the time more than doubled the hours of help received, and hours rose markedly with the number of activities for which help or equipment was needed most of the time. Frequency was one of the few disability measures where estimates suggested that persons using both help and equipment received fewer hours of help, although the large differences for frequent help with three or more ADLs were not significant.

When hours estimates were further limited to persons who received some combination of help and equipment, however, it was evident that the observed lower hours relative to the group using only help were attributable entirely to persons who received help but also performed at least one activity with only equipment. For disability levels of 3 or more ADLs, persons using equipment *with* assistance received significantly more hours of help than persons receiving only help; persons managing at least one activity with only equipment received significantly fewer hours.

Persons using equipment *with* assistance were more likely to have high levels of disabilities and received hours of care approaching three times the hours received by persons

who managed some activities with only equipment. Even controlling for the total number of ADL disabilities and the number of activities with which equipment was used, all persons with at least 3 ADLs who used equipment *with* assistance received significantly more hours of help than did persons who managed at least one activity with only equipment, and hours also rose within each disability level as the number of activities performed with both equipment and help increased. Conversely, as would be expected, hours fell with the number of activities performed independently with equipment.

Implications for Conceptual and Empirical Modeling

Several observations drawn from the descriptive results in this study have implications for multivariate models of the relationship between assistive device use and use of help and of impacts of device use on hours of care and other outcomes. Generally, better understanding of these relationships may require longitudinal analyses, more narrowly focused cross-sectional analyses, and more information on health status and changes in functional and other characteristics than have been typical in the literature to date.

First, persons using either type of accommodation alone differ significantly from each other and from persons using both, in the type and number of disabilities and the frequency with which accommodation is used. Studies to date have not determined whether exclusive use of one type of accommodation is most likely to be a transitional situation in a typical progression of accommodations used over time as functional status declines, or whether substantial heterogeneity exists. Longitudinal analyses may be able to provide insights into whether there is a typical ordering of the adoption of accommodations and what factors are associated with changes in accommodations or different orderings.

Although the 5-year survey cycle of the NLTCs does not allow for continuous observation of changes in functional status and accommodations, functional information from the 1994 survey and information from both rounds of the survey on the duration of individual disabilities can be used to construct indicators of the course of disability between the two survey rounds, including onset or resolution of disability or specific disabilities. Only the maximum duration over all disabilities was examined in this study. In addition, Medicare claims history from age 65 can be linked with each person in the NLTCs. This linkage allows for continuous information about the occurrence and timing of events, such as hospitalizations or use of post-acute care, which may affect acquisition and use of assistive devices use of assistance as well as augmenting limited survey reported information on chronic conditions.

Second, the majority of chronically disabled elders uses both equipment and help. They are about evenly divided between persons using equipment exclusively with assistance and persons who manage some disabilities with only equipment. Hours of care, however, are concentrated among the half of this group relying on help with or without equipment for all activities. Although persons using equipment *with* help are far more likely to be severely disabled, within each level of disability some persons are able to perform some activities with only equipment, with large impacts on the number of hours of help received. This suggests that analyses focusing on the majority of disabled elders who use some combination of help and equipment, abstracting from the probability of being in this group, may yield important insights into the scope for potential interventions to promote more independent function and into factors associated with greater or lesser hours of care when equipment is used with help. Such a focused analysis also reduces—but does not eliminate—the importance of endogeneity of living arrangement and choice of accommodations.

A key feature in such a focused model would be to build in information about recent changes in functional status, living situation, and recent health events that may help reveal the extent to which unobserved illness or disability severity, rather than other modifiable factors, explain observed use of equipment with or without help and differences in hours of care. Again, the ability to link Medicare claims history allows observation of recent salient events, such as hospitalization for hip fracture or stroke, or use of post-acute care, as well as providing additional information on chronic conditions.

In either cross-sectional or longitudinal modeling, it also may be important to consider the role of particular disabilities, notably mobility disability, in the accommodations used. It was seen, for example, that mobility-related devices are the most common type of device and that persons using mobility devices are more likely to use other devices as well. It was also seen that persons using a combination of equipment and help were far more likely to use equipment or help most of the time for transfer or indoor mobility than persons using equipment only for all disabilities.

Finally, as discussed earlier, other outcomes than hours of care are important in studies of the impact of assistive device use, including unmet need, impacts on caregiver health, changes in functional status, and health and long term care costs. It was seen that persons using both equipment and help were more likely to report unmet need for help than persons relying solely on equipment. That may or may not be true within the more disabled group using both. The 1999 NLTCs also includes a supplemental interview of primary caregivers which may support analysis of caregiver outcomes for different patterns of accommodation. Recently, additional years of additional years of Medicare claims as well as assessment data also have become available to federal contractors. These data offer the opportunity to examine other outcomes

relating to use of help and/or equipment, such as nursing home admissions, home health use, hospitalizations, and Medicare spending, as well as changes in functional status for persons who have assessment data as a result of either nursing home or home health care.

DRAFT

REFERENCES

- Agree, EM, and VA Freedman. 2000. "Incorporating Assistive Devices into Community-Based Long-Term Care: An Analysis of the Potential for Substitution and Supplementation." *Journal of Aging and Health* 12(3):426-450.
- Agree, EM, and VA Freedman. 2003. A Comparison of Assistive Technology and Personal Care in Alleviating Disability and Unmet Need. *The Gerontologist* 43(3): 335-344.
- Agree, EM, and VA Freedman. 2004. "Factors Influencing the Use of Mobility Technology in Community-Based Long-Term Care." *Journal of Aging and Health* 16(2):267-307.
- Allen, SM, A Foster, and K Berg. 2001. "Receiving Help at Home: The Interplay of Human and Technological Assistance." *Journal of Gerontology: Social Sciences* 56B (6):S374-S382.
- Agree, EM, VA Freedman, JC Cornman, DA Wolf, and JE Marcotte. 2005. "Reconsidering Substitution in Long Term Care: When Does Assistive Technology Take the Place of Personal Care?" *Journals of Gerontology: Social Sciences* 60B(5):S272-S280.
- Cornman, JC, VA Freedman, and EM Agree. 2005. "Measurement of Assistive Device Use: Implications for Estimates of Device Use and Disability in Late Life." *The Gerontologist* 45(3):347-358
- Freedman, VA, E Crimmins, RF Schoeni, BC Spillman et al. 2004. "Resolving Inconsistencies in Old-Age Disability Trends: Report from a Technical Working Group." *Demography* 41(3):417-441.
- Freedman, VA, LG Martin, and RF Schoeni. 2002. "Recent Trends in Disability and Functioning among Older Americans: A Critical Review of the Evidence." *Journal of the American Medical Association* 288:3137-46.
- Fuchs, V. 2004. "Reflections on the socio-economic correlates of health." *Journal of Health*

- Economics* 23:653-661.
- Guralnik, JM, Leveille SG, Hirsch R, Ferrucci L, Fried LP. 1997. "The impact of disability in older women." *Journal of the American Medical Women's Association* 52:113-20.
- Hoenig, H, DH Taylor, and FA Sloan. 2003. "Does Assistive Technology Substitute for Personal Assistance among the Disabled?" *American Journal of Public Health* 93(2): 330-337.
- Mann, WC, KJ Ottenbacher, L Fraas, M Tomita, and CV Granger. 1999. "Effectiveness of Assistive Technology and Environmental Interventions in Maintaining Independence and Reducing Home Care Costs for the Frail Elderly." *Archives of Family Medicine* 8:210-217.
- Manton, KG, L Corder and E Stallard. 1993. "Changes in the Use of Personal Assistance and Special Equipment from 1982 to 1989: Results from the 1982 and 1989 NLTCS." *The Gerontologist* 33(2):168-176.
- Pezzini, L., Kemper, P., and Reschovsky, J. 1996. "Does Publicly Provided Home Care Substitute for Family Care?: Experimental Evidence with Endogenous Living Arrangements." *Journal of Human Resources* 31, no. 3: 650-76.
- Pope, A, and A Tarlov, eds. 1991. *Disability in America: Toward a National Agenda for Prevention*. Washington, DC: National Academy Press.
- Schoeni, RF, VA Freedman, and RB Wallace. 2001. Persistent, consistent, widespread, and robust? Another look at recent trends in old-age disability. *Journal of Gerontology: Social Sciences* 56B:S206-S218.
- Spillman, BC. 2004. "Changes in Elderly Disability Rates and the Implications for Health Care Utilization and Cost." *The Milbank Quarterly* 82(1):157-194.

Verbrugge L. 1990. "Pathways of health and death." In: Apple RD, ed. *Women, health, and medicine in America: a historical handbook*. New York: Garland, 1990:41-79.

Verbrugge, LM, C Rennert, and JH Madans. 1997. "The great efficacy of personal and equipment assistance in reducing disability." *American Journal of Public Health* 87(3):384-92.

Verbrugge LM and P Sevak. 2002. "Use, type, and efficacy of assistance for disability." *Journals of Gerontology: Social Sciences* 57B:S366-79.

Waidmann, TA and K Liu. 2000. "Disability Trends among Elderly Persons and Implications for the Future." *Journals of Gerontology: Social Sciences* 55B:S298-307.

TABLES

DRAFT

Table 1. Trend in Assistive Device Use among Chronically Disabled Community Residents Age 65 or Older, 1984-1999

	1984		1989		1994		1999		Change 1984-1999
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
All chronically disabled elders	4,759,643	100.0	4,893,590	100.0	4,960,147	100.0	5,124,113	100.0	
Active or standby help only									
All activities	1,355,636	28.5	970,516	19.8	830,603	16.7	724,278	14.1	(14.3) **
Any activity	4,041,936	84.9	3,896,521	79.6	3,743,505	75.5	3,611,184	70.5	(14.4) **
Any equipment use									
All activities	717,707	15.1	997,069	20.4	1,216,642	24.5	1,512,929	29.5	14.4 **
Any activity	3,404,007	71.5	3,923,074	80.2	4,129,544	83.3	4,399,835	85.9	14.3 **
Equipment with no active or standby help									
All activities	628,318	13.2	864,835	17.7	1,053,514	21.2	1,264,772	24.7	11.5 **
Any activity	2,518,156	52.9	2,929,390	59.9	3,069,434	61.9	3,249,292	63.4	10.5 **
Equipment and active or standby help									
All activities	24,862	0.5	31,921	0.7	39,948	0.8	58,019	1.1	0.6 **
Any activity	1,730,693	36.4	2,041,483	41.7	2,147,523	43.3	2,293,086	44.8	8.4 **

Table 2. Trends in Use of Assistive Devices among Community Disabled Elderly, by Activity, 1984-1999

	1984		1989		1994		1999		Change 1984-1999
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Getting around outside	3,434,385	72.2	3,744,353	76.5	3,784,014	76.3	4,157,151	81.1	9.0 **
Active or standby help only	1,049,067	22.0	1,072,544	21.9	1,110,464	22.4	1,339,101	26.1	4.1 **
Any equipment use	2,385,318	50.1	2,671,808	54.6	2,673,550	53.9	2,818,050	55.0	4.9 **
Equipment only	1,503,300	31.6	1,765,526	36.1	1,757,882	35.4	1,823,981	35.6	4.0 **
Equipment and help	882,018	18.5	906,283	18.5	915,668	18.5	994,069	19.4	0.9
Bathing	2,500,119	52.5	2,898,625	59.2	3,029,743	61.1	3,306,933	64.5	12.0 **
Active or standby help only	1,140,672	24.0	1,086,367	22.2	963,456	19.4	690,838	13.5	(10.5) **
Any equipment use	1,359,447	28.6	1,812,258	37.0	2,066,287	41.7	2,616,095	51.1	22.5 **
Equipment only	658,835	13.8	849,629	17.4	923,145	18.6	1,249,637	24.4	10.5 **
Equipment and help	700,612	14.7	962,629	19.7	1,143,142	23.0	1,366,458	26.7	11.9 **
Getting around inside	2,300,353	48.3	2,698,989	55.2	2,782,330	56.1	2,918,242	57.0	8.6 **
Active or standby help only	387,742	8.1	410,846	8.4	328,116	6.6	394,818	7.7	(0.4)
Any equipment use	1,912,611	40.2	2,288,143	46.8	2,454,214	49.5	2,523,424	49.2	9.1 **
Equipment only	1,127,268	23.7	1,339,580	27.4	1,423,447	28.7	1,435,041	28.0	4.3 **
Equipment and help	785,343	16.5	948,563	19.4	1,030,767	20.8	1,088,382	21.2	4.7 **
Transfer	1,583,121	33.3	1,840,265	37.6	1,841,689	37.1	2,297,355	44.8	11.6 **
Active or standby help only	458,021	9.6	449,654	9.2	400,042	8.1	459,853	9.0	(0.6)
Any equipment use	1,125,100	23.6	1,390,611	28.4	1,441,647	29.1	1,837,502	35.9	12.2 **
Equipment only	514,048	10.8	652,785	13.3	644,068	13.0	895,553	17.5	6.7 **
Equipment and help	611,052	12.8	737,826	15.1	797,579	16.1	941,948	18.4	5.5 **
Toileting	1,412,881	29.7	1,710,890	35.0	2,014,493	40.6	2,117,913	41.3	11.6 **
Active or standby help only	476,054	10.0	232,465	4.8	374,812	7.6	403,559	7.9	(2.1) **
Any equipment use	936,827	19.7	1,478,425	30.2	1,639,681	33.1	1,714,354	33.5	13.8 **
Equipment only	462,542	9.7	709,286	14.5	941,449	19.0	923,501	18.0	8.3 **
Equipment and help	474,285	10.0	769,139	15.7	698,232	14.1	790,853	15.4	5.5 **
Dressing	1,219,493	25.6	1,350,021	27.6	1,333,961	26.9	1,399,278	27.3	1.7
Active or standby help only	1,131,669	23.8	1,228,947	25.1	1,189,052	24.0	1,256,078	24.5	0.7
Any equipment use	87,824	1.8	121,074	2.5	144,909	2.9	143,200	2.8	0.9 **
Equipment only ^a	31,981	0.7	50,878	1.0	57,016	1.1	51,573	1.0	0.3
Equipment and help	55,843	1.2	70,196	1.4	87,893	1.8	91,627	1.8	0.6 **
Eating	611,948	12.9	662,204	13.5	723,690	14.6	828,003	16.2	3.3 **
Active or standby help only	566,023	11.9	583,412	11.9	648,821	13.1	735,030	14.3	2.5 **
Any equipment use	45,925	1.0	78,793	1.6	74,868	1.5	92,974	1.8	0.8 **
Equipment only ^a	9,764	0.2	17,675	0.4	10,044	0.2	13,610	0.3	0.1
Equipment and help	36,161	0.8	61,118	1.2	64,825	1.3	79,363	1.5	0.8 **

^a Estimates do not meet a precision standard of relative standard error less than 30 percent.

Table 3. Trend in Use of Specific Devices by Activity among Chronically Disabled Community Residents Age 65 or Older, 1984-1999

	1984		1989		1994		1999		Change 1984-1999
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Getting around outside									
Walker/cane/crutch	2,102,376	44.2	2,407,172	49.2	2,363,073	47.6	2,545,491	49.7	5.5 *
Cane	1,757,624	36.9	1,905,645	38.9	1,840,123	37.1	1,938,842	37.8	0.9
Walker	427,897	9.0	699,397	14.3	736,875	14.9	928,879	18.1	9.1 *
Wheelchair	271,549	5.7	378,511	7.7	433,792	8.7	577,931	11.3	5.6 *
Other device	207,879	4.4	199,983	4.1	303,579	6.1	308,782	6.0	1.7 *
Bathing									
Shower seat/tub stool	681,970	14.3	1,019,039	20.8	1,270,738	25.6	1,899,401	37.1	22.7 *
Grab bars/rail	817,039	17.2	1,047,645	21.4	1,184,835	23.9	1,698,059	33.1	16.0 *
Rubber mat	286,605	6.0	394,767	8.1	512,832	10.3	988,806	19.3	13.3 *
Hand-held shower	117,424	2.5	188,611	3.9	374,981	7.6	696,765	13.6	11.1 *
Walker/Cane	97,927	2.1	147,862	3.0	242,156	4.9	471,669	9.2	7.1 *
Other Device	87,327	1.8	125,073	2.6	143,317	2.9	65,423	1.3	(0.6)
Getting around inside									
Walker/cane/crutch	1,665,397	35.0	2,020,303	41.3	2,116,372	42.7	2,235,099	43.6	8.6 *
Cane	1,184,267	24.9	1,364,370	27.9	1,381,658	27.9	1,451,923	28.3	3.5 *
Walker	692,077	14.5	993,362	20.3	1,129,566	22.8	1,324,017	25.8	11.3 *
Wheelchair	378,421	8.0	487,653	10.0	581,006	11.7	800,446	15.6	7.7 *
Railing	46,962	1.0	92,166	1.9	105,897	2.1	230,087	4.5	3.5 *
Furniture/Walls	110,287	2.3	157,344	3.2	157,305	3.2	196,227	3.8	1.5 *
Pros/brace/shoe	86,562	1.8	27,922	0.6	124,995	2.5	130,578	2.5	0.7
Other device	72,278	1.5	113,533	2.3	230,323	4.6	281,448	5.5	4.0 *
Getting in or out of bed									
Walker/cane/crutch	900,237	18.9	1,128,070	23.1	1,146,103	23.1	1,563,568	30.5	11.6 *
Walker	477,686	10.0	626,522	12.8	712,207	14.4	1,023,939	20.0	9.9 *
Cane	539,073	11.3	682,776	14.0	660,199	13.3	917,250	17.9	6.6 *
Wheelchair	274,546	5.8	408,770	8.4	432,418	8.7	694,052	13.5	7.8 *
Railing	36,352	0.8	85,168	1.7	89,624	1.8	218,700	4.3	3.5 *
Other device	121,314	2.5	155,096	3.2	174,231	3.5	163,542	3.2	0.6
Toileting									
Raised Toilet	273,773	5.8	523,034	10.7	757,848	15.3	946,028	18.5	12.7 *
Rail/Grab bar	274,831	5.8	393,703	8.0	503,550	10.2	638,842	12.5	6.7 *
Portable Toilet	342,141	7.2	481,130	9.8	443,991	9.0	516,077	10.1	2.9 *
Cane/Walker	150,046	3.2	237,395	4.9	317,154	6.4	470,921	9.2	6.0 *
Special underwear	57,100	1.2	133,383	2.7	201,360	4.1	319,842	6.2	5.0 *
Bedpan or Urinal	162,503	3.4	192,351	3.9	177,349	3.6	191,854	3.7	0.3
Other device	163,993	3.4	160,663	3.3	270,033	5.4	176,534	3.4	(0.0)

Table 4. Trend in Use of Specific Assistive Devices for All Activities among Chronically Disabled Community Residents Age 65 or Older, 1984-1999

	1984		1989		1994		1999		Change 1984-1999
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Walker/cane/crutches	2,528,032	53.1	2,899,565	59.3	3,001,267	60.5	3,331,661	65.0	11.9 **
Railing/grab bars	994,485	20.9	1,320,254	27.0	1,488,783	30.0	2,026,721	39.6	18.7 **
Shower seat/tub stool	681,970	14.3	1,019,039	20.8	1,270,738	25.6	1,899,401	37.1	22.7 **
Wheelchair/scooter	480,632	10.1	665,951	13.6	795,612	16.0	1,130,828	22.1	12.0 **
Rubber mat	286,605	6.0	394,767	8.1	512,832	10.3	988,806	19.3	13.3 **
Raised toilet	273,773	5.8	523,034	10.7	757,848	15.3	946,028	18.5	12.7 **
Hand-held shower	117,424	2.5	188,611	3.9	374,981	7.6	696,765	13.6	11.1 **
Portable toilet/bedside commode	342,141	7.2	481,130	9.8	443,991	9.0	516,077	10.1	2.9 **
Other indoor or outdoor mobility devices	151,137	3.2	202,712	4.1	351,908	7.1	399,544	7.8	4.6 **
Special underwear/diapers	57,100	1.2	133,383	2.7	201,360	4.1	319,842	6.2	5.0 **
Furniture/walls	110,287	2.3	157,344	3.2	157,305	3.2	196,227	3.8	1.5 **
Special clothing or dressing devices	87,824	1.8	121,074	2.5	144,909	2.9	143,200	2.8	0.9 **
Special utensils or dishes	45,925	1.0	78,793	1.6	74,868	1.5	92,974	1.8	0.8 **
Distribution by Major Mobility Devices and Other Devices									
Walker, cane, crutch, or wheelchair	2,713,795	57.0	3,106,434	63.5	3,255,151	65.6	3,596,367	70.2	13.2 **
Walker, cane, crutch, or wheelchair and other devices	1,456,278	30.6	1,981,167	40.5	2,208,368	44.5	2,596,712	50.7	20.1 **
Walker, cane, crutch, or wheelchair only	1,257,517	26.4	1,125,268	23.0	1,046,783	21.1	999,655	19.5	-6.9 **
Other devices only	690,212	14.5	816,640	16.7	874,393	17.6	803,469	15.7	1.2

Note: **(*) indicates that difference is significantly different from zero at the 5% (10%) level in a two-tailed test.

Table 5. Disability Characteristics of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999

	Equipment only for all chronic disabilities ^a		Equipment and personal assistance for chronic disabilities ^b		Personal assistance only for all chronic disabilities ^c	
	Number	Percent	Number	Percent	Number	Percent
All	1,290,079	100.0	3,045,374	100.0	788,660	100.0
Physical limitations						
None	186,586	14.5	96,338	3.2	207,380	26.3
Upper body only	19,891	1.5	18,691	0.6	19,601	2.5
None or upper body only	206,477	16.0 **	115,029	3.8 **	226,981	28.8 **
Lower body only	645,342	50.0 **	716,244	23.5 **	254,672	32.3 **
Both upper and lower body	438,260	34.0 **	2,214,100	72.7 **	307,006	38.9
Disabilities present						
Getting around outside	980,864	76.0 **	2,847,436	93.5 **	328,852	41.7 **
Bathing	681,208	52.8 **	2,436,946	80.0 **	188,778	23.9 **
Getting around inside	493,458	38.3 **	2,323,832	76.3 **	100,953	12.8 **
Transfer	262,712	20.4 **	1,911,973	62.8 **	122,670	15.6 *
Toileting	246,013	19.1 **	1,761,593	57.8 **	110,307	14.0 **
Dressing	36,025	2.8 **	1,228,919	40.4 **	134,333	17.0 **
Eating	7,518	0.6 ** #	731,537	24.0 **	88,948	11.3 **
Disability level						
IADL only	245,388	19.0 **	131,018	4.3 **	512,813	65.0 **
1-2 ADLs	864,221	67.0 **	962,740	31.6 **	168,138	21.3 **
3-4 ADLs	177,564	13.8 **	956,640	31.4 **	35,178	4.5 **
5-6 ADLs	2,907	0.2 ** #	994,976	32.7 **	72,531	9.2 **
Duration of chronic disability						
Less than 1 year	146,084	11.3	369,499	12.1 *	129,008	16.4 **
1 year to 5 years	595,407	46.2	1,501,545	49.3	393,003	49.8
5 years or longer	548,588	42.5	1,174,329	38.6	266,650	33.8 **
Help or equipment with any ADL most of the time	742,889	57.6 **	2,540,547	83.4 **	95,721	12.1 **
Number of ADLs with help or equipment most of the time						
None	547,190	42.4 **	504,826	16.6 **	692,939	87.9 **
1-2	643,252	49.9 **	1,180,099	38.8 **	72,847	9.2 **
3-4	97,830	7.6 **	942,154	30.9 **	18,625	2.4 **
5-6	1,807	0.1 **	418,294	13.7 **	4,250	0.5
Help or equipment with transfer or indoor mobility most of the time	322,717	25.0 **	1,964,149	64.5 **	30,927	3.9 **
Number of ADL activities with help/supervision						
None	1,272,800	98.7 **	855,922	28.1 **	521,645	66.1 **
1-2	12,932	1.0 ** #	894,718	29.4 **	160,233	20.3 **
3-4	3,247	0.3 ** #	464,093	15.2 **	34,251	4.3 **
5-6	1,100	0.1 ** #	830,640	27.3 **	72,531	9.2 **
Number of ADL activities with equipment						
None	245,388	19.0 **	181,326	6.0 **	778,184	98.7 **
1-2	868,501	67.3 **	1,450,190	47.6 **	10,476	1.3 ** #
3-4	174,383	13.5 **	1,347,018	44.2	0	—
5-6	1,807	0.1 ** #	66,840	2.2	0	—
Help needed or more help needed with any ADL	1,100	0.1 ** #	625,832	20.6 **	83,418	10.6 **
Help needed with any IADL for which no help received	304,669	23.6 **	1,190,927	39.1	329,511	41.8 **

Notes: # indicates that estimate does not meet the precision criterion of standard error less than 30 percent of estimate.

^a **(*) denotes a significant difference between those who rely solely on equipment and those who use both help and equipment at the 5 (10) percent level in a two-tailed test.

^b **(*) denotes a significant difference between those who use both help and equipment and those who use only help at the 5(10) percent level in a two-tailed test.

^c **(*) denotes a significant difference between those who use only help and those who use only equipment at the 5(10) percent level in a two-tailed test.

^d Persons were considered limited if they reported that it was somewhat difficult or very difficult to perform any of eight activities or that they could not do the activity at all. The lower body activities are walking up a flight of stairs, walking across a room and back, bending to put on socks or stockings, and lifting and holding a 10-pound package. Those who were chairfast or bedfast were considered limited in lower body activities. Upper body limitations are reaching above the head, combing or brushing hair, washing hair, and using the fingers to grasp and hold small objects. Less than three percent of those receiving only help and even smaller proportions of the other two groups reported only upper body limitations. They have been combined with persons reporting no limitations of either type.

Table 6. Support and Physical Environment of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999

	Equipment only for all chronic disabilities ^a		Equipment and personal assistance for chronic disabilities ^b		Personal assistance only for all chronic disabilities ^c	
	Number	Percent	Number	Percent	Number	Percent
All	1,290,079	100.0	3,045,374	100.0	788,660	100.0
Living arrangement						
Alone	705,188	54.7 **	1,054,647	34.6 *	231,064	29.3 **
With spouse	394,696	30.6 **	1,091,421	35.8 **	366,648	46.5 **
With others	190,195	14.7 **	899,306	29.5 **	190,948	24.2 **
Residential type						
Private residence	1,038,816	80.5 **	2,564,722	84.2 **	696,031	88.3 **
Community residential care	64,186	5.0 **	220,034	7.2 **	24,693	3.1
Other setting for older or disabled persons	187,078	14.5 **	260,618	8.6	67,937	8.6 **
Accommodative features present						
None	581,144	45.0	1,262,936	41.5 **	658,488	83.5 **
Extra handrails or grab bars	570,306	44.2	1,281,986	42.1 **	82,847	10.5 **
Raised toilet	210,218	16.3 **	799,100	26.2 **	26,192	3.3 **
Extra wide doors or hallways	146,624	11.4	373,761	12.3 **	24,165	3.1 **
Elevators or chair lifts	124,967	9.7	253,766	8.3 **	23,310	3.0 **
Ramps	94,913	7.4 **	454,339	14.9 **	34,888	4.4 *
Push bars on doors	48,778	3.8	147,084	4.8 **	7,968	1.0 ** #
Desirable accommodative features						
None	937,643	72.7 **	1,983,240	65.1 **	645,497	81.8 **
Extra handrails or grab bars	224,601	17.4 *	656,019	21.5 **	95,877	12.2 *
Raised toilet	117,883	9.1 **	373,794	12.3 **	41,240	5.2 **
Elevators or chair lifts	76,413	5.9	162,118	5.3 *	23,097	2.9 ** #
Ramps	46,187	3.6 **	270,139	8.9 **	24,824	3.1
Extra wide doors or hallways	33,107	2.6 **	180,879	5.9 **	9,331	1.2 * #
Push bars on doors	29,567	2.3 * #	126,745	4.2 *	18,591	2.4 #

Notes: # indicates that estimate does not meet the precision criterion of standard error less than 30 percent of estimate. Accommodative features are sorted by their prevalence among persons using only equipment.

^a **(*) denotes a significant difference between those who rely solely on equipment and those who use both help and equipment at the 5 (10) percent level in a two-tailed test.

^b **(*) denotes a significant difference between those who use both help and equipment and those who use only help at the 5(10) percent level in a two-tailed test.

^c **(*) denotes a significant difference between those who use only help and those who use only equipment at the 5(10) percent level in a two-tailed test.

Table 7. Socioeconomic Characteristics of Chronically Disabled Community Residents Age 65 or Older by Equipment Use or Nonuse, 1999

	Equipment only for all chronic disabilities ^a		Equipment and personal assistance for chronic disabilities ^b		Personal assistance only for all chronic disabilities ^c	
	Number	Percent	Number	Percent	Number	Percent
All	1,290,079	100.0	3,045,374	100.0	788,660	100.0
Age						
65-74	354,987	27.5	802,675	26.4 **	294,900	37.4 **
75-84	643,496	49.9 **	1,239,777	40.7	327,238	41.5 **
85+	291,596	22.6 **	1,002,922	32.9 **	166,523	21.1
Gender						
Female	930,857	72.2	2,133,056	70.0 **	447,038	56.7 **
Male	359,223	27.8	912,318	30.0 **	341,622	43.3 **
Race						
Black	122,535	9.5	365,197	12.0	111,335	14.1
White or other	1,167,545	90.5	2,680,177	88.0	677,325	85.9
Education						
Less than high school	469,453	36.4 **	1,545,273	50.7	424,596	53.8 **
High school graduate	405,782	31.5 **	799,527	26.3	187,150	23.7 **
Some college	414,844	32.2 **	700,574	23.0	176,913	22.4 **
Categorical income						
Less than \$10,000	378,789	29.4 *	1,077,017	35.4	262,526	33.3
\$10,000 - \$20,000	456,600	35.4	1,074,088	35.3	254,700	32.3
\$20,000 - \$30,000	230,333	17.9 *	420,293	13.8 *	154,834	19.6
\$30,000 or more	224,357	17.4	473,976	15.6	116,600	14.8
Income relative to poverty, married						
Less than poverty	33,009	8.2 *	150,292	13.5	38,965	10.3
1-2 times poverty	113,324	28.1 **	416,885	37.4	126,676	33.4
2-3 times poverty	117,889	29.3 *	248,592	22.3 **	119,748	31.6
3-4 times poverty	64,264	16.0 *	117,563	10.5	57,217	15.1
4 times poverty or higher	74,140	18.4	181,301	16.3 **	36,318	9.6 **
Income relative to poverty, unmarried						
Less than poverty	206,408	23.3 **	600,957	31.1 *	156,239	38.1 **
1-2 times poverty	362,050	40.8	779,425	40.4	159,303	38.9
2-3 times poverty	180,833	20.4	332,519	17.2	55,741	13.6 **
3-4 times poverty	52,209	5.9 **	42,728	2.2	15,389	3.8 #
4 times poverty or higher	85,953	9.7	175,112	9.1 **	23,065	5.6 *

Notes: # indicates that estimate does not meet the precision criterion of standard error less than 30 percent of estimate.

^a **(*) denotes a significant difference between those who rely solely on equipment and those who use both help and equipment at the 5 (10) percent level in a two-tailed test.

^b **(*) denotes a significant difference between those who use both help and equipment and those who use only help at the 5(10) percent level in a two-tailed test.

^c **(*) denotes a significant difference between those who use only help and those who use only equipment at the 5(10) percent level in a two-tailed test.

Table 8. Mean weekly hours of care for equipment users and nonusers, 1999

	Equipment and personal assistance	Personal assistance only	Difference
All	41	26	15 **
Physical limitations			
None or upper body only	25	24	1
Lower body only	27	25	2
Both upper and lower body	46	28	18 **
Disabilities present			
Getting around outside	42	31	11 **
Bathing	45	43	3
Getting around inside	46	51	-5
Transfer	50	49	1
Toileting	52	51	0
Dressing	64	49	15 **
Eating	75	56	18 **
Disability level			
IADL only	19	17	2
1-2 ADLs	21	26	-5
3-4 ADLs	30	48	-18
5-6 ADLs	70	58	11
Duration of chronic disability			
Less than 1 year	46	17	29 **
1 year to 5 years	41	29	12 **
5 years or longer	39	26	12 **
Help or equipment with any ADL most of the time			
No	24	23	1
Yes	44	44	0
Help with transfer or indoor mobility most of the time			
No	27	25	2
Yes	48	47 #	0
Number of ADLs with help or equipment most of the time			
None	24	23	1
1-2	29	35	-6
3-4	41	62	-20
5-6	86	118 #	-32
Number of ADL activities with help/supervision			
None	18	17	1
1-2	23	25	-3
3-4	44	49	-5
5-6	76	58	18 *
Number of ADL activities with equipment			
None	19	26	-7 *
1-2	32	28 #	4
3-4	50	—	
5-6	73	—	
Help needed or more help needed with any ADL			
No	38	24	14 **
Yes	52	42	10
Help needed with any IADL for which no help received			
No	43	29	14 **
Yes	37	23	14 **

Note: **(*) denotes that difference is significantly different from zero at the 5% (10%) level in a two-tailed test.

Table 9. Mean weekly hours of care for persons using both help and equipment, 1999

	Percent of persons	Average hours of help
All using both help and equipment	100.0	41
No ADLs with equipment ^a	5.1	19
No ADLs with equipment only		
All	46.9	61
1-2 ADLs, 1-2 with help and equipment	8.4	24
3-4 ADLs		
1-2 with help and equipment	4.9	42
3-4 with help and equipment	4.8	52
5-6 ADLs		
1-2 with help and equipment	9.5	62
3 or more with help and equipment	19.2	85
One or more ADLs with equipment only		
All	48.0	23 **
1-2 ADLs		
No ADLs with help	12.9	18 **
One ADL with help	6.6	23
3-4 ADLs		
1-2 ADLs with equipment only	13.0	25 **
3-4 ADLs with equipment only	9.2	19 **
5-6 ADLs		
1-2 ADLs with equipment only	4.4	43 **
3-4 ADLs with equipment only	1.8	19 **

Notes: **(*) indicates that difference in hours for persons with a similar number of ADLs but no ADLs managed with equipment only is significantly different from zero at the 5(10) percent level in a two-tailed test.

^a Equipment use for getting around outside only